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TUBERCULOSIS IN RELATION TO FEEBLE-MINDEDNESS

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I AM QUITE AWARE that my personal opportunities for collecting information are not such as to entitle me to express any dogmatic conclusions on the subject I have chosen to talk about for a few moments, and yet it is perhaps true that owing to my position as Chief Medical Inspector of Immigration in Canada I have had some phases of so many mental and physical conditions brought to my attention that I catch the reflection from objects better suited to the eye at long range than if they are brought too near and the angle of incidence is too acute for proper vision.

In his chapter on "The Casual Factore of Amentia," Dr. Tredgold, Medical Expert to the Royal Commission on the Feeble-minded, says: "I believe that ancestral tuberculosis is but rarely the direct and sole cause of amentia; but my observations show that like alcoholism, it has an important indirect and possibly also a contributory influence." He further states: "With regard to persons suffering from amentia I found a pronounced tendency to tubercular lesions in the families of 34 per cent. of cases investigated. He further states: "There can be no doubt but that the death rate from tuberculosis is very much higher (nearly four times as much) in the case of aments than it is in the non-defective population." Now, at a first glance, these statements would seem to prove beyond dispute that tuberculosis plays a very important contributory if not a directly inciting cause in feeble-mindedness. Yet Tredgold himself states: "It is to be noted, however, that a history of antecedent tuberculosis rarely occurs alone; in four-fifths of my own cases it was accompanied by a definite neuropathic inheritance while in the remaining fifth other conditions, usually alcoholism, were also present." It is apparent that statistics on the subject are very inconclusive, since several possible factors seem so commonly present. Recent more exact study inclines to the conclusion that in most Anglo-Saxon communities, whether in Europe or America, the feebleminded of all degrees probably are not less than 5 per cent. in most communities; yet if the death-rate from tuberculosis be put at 0.15 per cent. and the sick from the disease at ten times as many or 1.5 per cent. in all, we find that there seems statistically no relationship between the two; yet it must have frequently been forced upon the attention of those who have had much to do with the tuberculized that one of the most obvious conditions present is what for lack of a better term we may call a nerve instability. I remember that a good many years ago a Dr. May of Philadelphia wrote many articles to prove that tuberculosis was in every sense a disease of the nervous system, and doubtless we have many clinical conditions during the disease in which nervous symptoms play a most important part. Dealing then with the broad aspects of the probable relationship between feeblemindedness and tuberculosis, we have to go back to that subject which has been for years and is likely to be for years to come the occasion of much discussion and investigation, viz., the immutability of germ plasm. Without entering into the discussion, I

wish again to quote what Dr. Tredgold says after a quite full discussion of the subject: "I hold that primary amentia is a manifestation of apathological germinal variation which has been produced by the environment, and that the germinal change is of the nature of a vitiation, that is to say, it consists of an impairment of the intrinsic potentiality for development, which may be widespread and affect the germ as a whole or which may be less extensive and confined to the neuronic determinant. At the beginning in most instances the latter is probably the case and the central change is but slight. It shows itself merely in a diminished function stability and durability of the higher and therefore an increased excitability of the lower cerebral neurones and is revealed clinically as neurasthenia, hysteria, migraine and the milder forms of epilepsy. We may say in fact that these states are the first indications of the presence of the psychopathic diathesis. Should an adverse environment continue, or should a person so affected mate with one similarly tainted, then in the next generation the neuronic durability will be further diminished and the instability accentuated so that insanity, the graver forms of epilepsy and early dementia make their appearance. If the process is further continued the third generation will often be characterized by a tendency to defects of anatomical structure and there will be a strong probability of one or more of the offspring suffering from amentia. Should this germinal impairment be accompanied by any untoward circumstances during the growth of the embryo this probability will become a tolerable certainty. Degeneracy is here well established and the well-known stigmata, indicative of an extensive germinal change are usually abundant. Finally a condition of gross idiocy appears with complete sterility and the family becomes extinct."

The breadth of Tredgold's observation and the obviously sane and practical conclusions drawn make them a convenient basis upon which anything I may say will be based. We all know of mountain valleys in Europe or old-time settlements in America where through intermarriage have been transmitted at times a general cretinism or a general feeblemindedness so marked as to give their people special historic characteristics. The story of the Martin Kallikak family so well worked out by Goddard well illustrates the fact, and others of us doubtless know family hereditary strains quite as marked although not so well worked out statistically. It is a priori quite remarkable that in every work dealing with what we may especially term social diseases as distinct from the acute infections, viz., tuberculosis, alcoholism, syphilis and feeblemindedness, we find them so intermingled often that it seems quite impossible to determine which disease is the determinant or dominant one. For instance, I can recall a family history, many of whose members have been known to me and about whom speaking thirty years ago with my father we together in a few minutes counted eighty persons who had showed insanity of a katatonic type with mild delusions and periodic acute manifestations. The lists extended back through five generations known either to my father or myself. They were a family many of whom were noted for their beauty, having delicate complexions with golden hair, but in whom the neurotic manifestations were marked especially by mental instability and in a number of cases were associated with consumption. Speaking generally the mentality of the various branches of the family was more than usually good and in two distinct branches descended from brothers intermarriage in the second generation with strong stocks of different races in two instances has produced most favorable results in the fourth generation in the offspring of two second cousins of the fourth generation who intermarried. In all except the last offspring the four generations were country or village bred. We may hence fairly assume that the new blood and good rural surroundings have been building directly toward a neuronic stability, while had the high tension of urban life and rush been allowed to exert its ordinary influence the departure from the normal would continue. It is interesting to compare this family with the Kallikak family whose history is given with so much accuracy in Goddard's book. In this group the cases starting from a low type under adverse physical environment

continue on the same or even a descending plane; but in all cases we revert to the same old question what is the real underlying cause or causes of the phenomena in any given group of cases. Goddard states that of 1,200 cases of feeblemindedness in the Royal Albert Asylum phthisis is mentioned in 291 families or 24 per cent. of the whole; but no evidence is given that the phthisis present in the children in these families was the cause of feeblemindedness. No close analysis evidently was made through an attempt to go farther in these cases. In 327 cases whose family histories have been studied by Goddard we get a very interesting analysis made:

1. Certain heredity—164 or 54 per cent.; many relatives feebleminded.
2. Probable heredity—34 or 11.3 per cent.; some relatives.
3. Neuropathic ancestry—37 or 12 per cent.; family histories showed various brain affections from apoplexy to blindness.
4. Accidental cases—57 or 19 per cent.
5. Unaccounted—8 or 2 per cent.

Speaking of tuberculosis as a causative factor in 324 cases Goddard points out that cases of tuberculosis are scattered through families in all the four groups and their incidence is such as would be accounted for by contagion. Some of these families show many cases of tuberculosis "due to the low social order of these people," but a recent Social Survey on Tuberculosis in Cincinnati says regarding low wages and tenements: "Such a low subsistence level works like black magic in the spread of tuberculosis." After this statement follows a remarkable statistic by Dr. Goddard which gives only 2.8 per cent. of all the 324 cases studied as being marked tuberculosis on the chart, while he states the percentage of tuberculized in the general population is from 10 per cent. to 15 per cent. He then draws a somewhat remarkable deduction when he says: "This agrees with the view that feebleminded stock may be primitive and possessed of much animal strength and possibly some immunity from disease." The inference is based upon altogether too limited and imperfect data to be of real value, since we find in actual statistics for over 2,000 school children that in the children of slum areas, largely British immigrants, the feebleminded are over 5 per cent. of the whole, while the prevalence of tuberculosis has long been known to be directly the measure of bad housing. As I have written elsewhere and as all other sanitary and social workers have observed: "Tuberculosis is a disease of house life, not the disease of the pioneer shack town; it is the pest of the densely populated city with its slums, overcrowded work rooms and factories. Remembering that the statistics do not note more than the most clearly defined cases of tuberculosis of the lungs, as Dr. Goddard states, and as we further note the great proportion of the feebleminded cases examined will have been children among whom consumption is rare as compared with other forms of tuberculosis, I think it may be taken for granted that we can draw but few definite conclusions from these data. The study of Goddard's cases shows much the same with regard to alcohol and leads him to the general conclusion that "Everything seems to indicate that alcoholism itself is only a symptom, that for the most part occures in families where there is some form of neurotic taint especially feeblemindedness." If the result of the careful examination of the antecedents of the feeblemindedness cannot associate them either with tuberculosis or with alcohol as the exciting cause and leads us to infer that the feeblemindedness are for the most part descended from the feebleminded, we seem to be forced back upon the conundrum posed by Dr. Tredgold when, speaking of Weismann's, Davenport's, and the others' theory of immutability of germ plasm which must be assumed to belong to members of the Simian family, he says: "One cannot help wondering how their descendants evolved into human beings at all." and then goes on to say: "I very much doubt whether the phylogeny of civilized man was ever represented by a phase of evolution comparable with that of mental defect." . . . "In short, I regard the germinal variation present in these persons as a pathological one; as being of the nature of a vitiation, which instead of being of spontaneous origin is really due to negation or diminution of spontaneity. How then

is this impairment brought about? I consider it is primarily due to the action of the environment."

We are thus brought fairly to the crux of our problem. What are we to understand by environment? We have what we call external environment, which is post-natal. The native from the Arctic Circle to the Equator in every part of the globe is subject to it. The Ojibway Indians of Champlain's time on the shores of Lake Superior are pictured as almost naked in their sun-dances and as living on game, fish, and herbs; while the Iroquois had their villages and cultivated lands and great tribal federations. Similarly the Tasmanian bushmen of the southern hemisphere remained savages, while the Maories of New Zealand were a proud and intellectual race with federated organization and well developed ideas of land ownership. Evidently there is much in transmitted qualities in spite of mere climatic environment. On the other hand if we compare Col. Ogle Thorpe's settlements in Georgia of the people from the slums of London placed where the environment was negro slavery with the thousands of the criminal class shipped to Australia, we must confess to the potential influence of environment both physical and human in each case. Indeed, it is this latter to which we must lend our attention. Take city life with its persistent high tension, with its constant attacks upon the nervous system, both through business and pleasure, whether in high finance or in the competition of trade, whether in the pursuit of the science of medicine, or even in the charities and other social work. It appears to me that we have to widen our outlook in order to observe the broad effects of urban modern life on the one hand and on the other to endeavor to realize what internal environment means. Similarly there is prenatal environment. We understand the rapidity of cell multiplication and know that there is cell differentiation in the ovum. We further know that from the simplest particle of vital protoplasm through all the stages of cell evolution up to pyramidal brain cells and those of the ductless glands such depend upon normal nutrition for their growth while we learn from feeding experiments, as well as investigations into the antecedents of monsters in animals at birth of the distinctly injurious effects upon young chicks during incubation of irregular heating, deficient moisture and impure air as well as of the destructive effects upon the foetus of systematic poisons, whether mineral as in lead poisoning or of infectious diseases as in smallpox which often result in its death. But much more serious because more general are the hammreing effects, to use a mechanical term, of urban life upon the nervous system. Every observant physician, taking stock of his female patients, endeavors to remove the prospective mother from an untoward environment when he notices the undue strain upon her nervous system. For multitudes of the poorer class rest is impossible; but Nature with her resources has often through their habits of labor supplied the defence or an originally less impressible nervous system with a rugged nutrition, the outcome of physical labor But to many women the noise, the rush, the excitement in their daily lives results either in a complete nerve exhaustion or in a neurasthenia though occasionally in a response of Nature to the demand for an extra output of energy when under physical pain or some great emotion as war an abnormal resistance is developed through the sympathetic nervous system. But it is most true as expressed by John Martin that "Appallingly common are the cases of girls with these nervous organizations and delicate brains, whose latent maturity has been rendered a torture by the exhaustion following on their conscientious obedience to the demands of school and college, of social work, or society life." The most noticeable gross effects are seen in the general reduction in the birthrate in all progressive countries where urbanization is going on rapidly. Thus Dr. Newsholme, Chief Medical Officer, has estimated that had the birth rate of England and Wales been the same in 1914 as in 1876 there would have been 467,837 more infants born there in 1914 than actually saw the light. In a recent report to the Prussian Diet it was stated that there were 560,000 fewer births in Germany than would have occurred if the birthrate of 1900 had been maintained. It was further declared that the decline in

birthrate in Germany in twelve years had been as rapid as that in France in seventy and that births had dropped 75 per cent. more than the number of deaths. The most important speakers at the Society dealing with the problem pointed out that the cause is essentially economic, the average marriage age for men being now 29 and for women 26. Earlier marriage was urged as tending to lessen syphilis and illegitimacy. There are 180,000 illegitimate born every year in Germany. The recognition of the serious effects upon the child, in its prenatal stage, as well as upon the mother of disease and disturbed mental conditions is illustrated in the very successful work being done in Maternity Hospitals through the care of the mother during this period. Thus in 34 cases treated in Edinburgh during three months 17 had albuminuria yet 33 were safely delivered; but there were 46 per cent. of still births, although 80 per cent. of the mothers were married. The obvious need for ante-natal clinics is thus made apparent.

We have thus illustrated the general effects of environment on prenatal health and may now revert to the direct influence of tuberculosis during this period. All will have noted how the progress of tuberculosis often for the time is stayed during pregnancy. Foetal life often greatly stimulates appetite and nutrition in the mother, only to be followed by a complete breakdown during lactation. During gestation, therefore, it may be that the toxic effects of the tuberculous process are lessened or that they may act as an immunizing factor in the child; but the large number of tubercular cases, where the child becomes apparently directly inoculated from the mother after birth, suggests that the amount of antecedent immunization must have been small. Regarding its direct effects in providing feeblemindedness, Tredgold, like Goddard, says: "I believe that ancestral tuberculosis is but rarely the direct sole cause of amentia; but my observation shows that like alcoholism, it has an important indirect and possibly also a contributory influence. This indirect effect is seen in its potency to produce the milder and initial forms of nervous instability in the offspring such as migraine, hysteria and neurasthenia, a clinical fact which has been frequently noticed. It is very remarkable how in the works of the two great authorities on amentia quoted each constantly turns to the condition of neuronic instability, which finds its daily illustration and expression in the effects of modern urbanization. Let any family physician declare his experience and he will tell that his chief energies are spent upon patching up systems, where there is anaemia, malnutrition, functional disturbances of organs, inability to perform normal duties and where some nerve whip or tonic is frequently being required, much of this condition soon disappearing with rest under changed environment as at some rest-cure. In many of this class certain common symptoms are observable, such as an actual dislike of even physical distress at the appearance of the older, coarse forms of food as fats, oatmeal and so on, and a longing for sweet or spiced foods which excite appetite or stimulate the gustatory nerves. Indeed, it is abundantly plain that the food of the well-to-do in America is usually very different from that of the sturdy immigrant peasant whether Russian, Austrian or Italian, while it is very probable that amongst the other vices of our civilization that of an irrational dietary and of foods of imperfect nutritive elements due to the robbing of our common foods, as the grains of their salts and vitamines is not the least important. What we are assured of is that though the protective and preventive measures against the direct attacks of tuberculosis and other infectious diseases are being constantly multiplied by science and official supervision, yet the breaking down of the nerve defences proceeds constantly through the thousand and one modern influences hammering at our brain through the special sense, as noises, movies and the dissipating effects of abnormal occupations and of irregular hours which exhaust the physical powers and the ability to resist degenerative or malign causes operating against the normal physical and mental processes. We have observed the phenomenon of how in almost every country, certainly in North America the rural population of 50 years

ago was 25 per cent. of the total, while in the United States and Canada at least 50 per cent. of the total population is to-day urbanized in cities of 5,000 or over; that probably 25 per cent. more are sub-urbanites and in small villages and towns leaving but 25 per cent. actually engaged in agriculture. The effects of the change upon two succeeding generations are now becoming apparent and we are seriously asking ourselves whether phylogeney will disappear in its old normal developmental influences to be replaced by some modern man-created eugenics, adequate to cope with the changed environment including habits of life, housing, occupation and education. We know that our total death rate as in New York has been cut in two in fifty years, but we likewise know that the saving is due almost solely to the application of what we may term artificial methods. To give some instances:

1. We have enormously limited the birth rate, leaving, we are told, just so much more time to care for the new-born.

2. The nursing mother has, however, almost disappeared, while much more time is occupied in the attempts to make the child of the neurotic mother with its hyper-sensitive nerve reflexes of the digestive organs digest artificially prepared foods.

3. The child with no green pastures to run in beside the still waters, is at the best conveyed from the flat to the nearest park by the typical nurse girl, although, indeed, most urban children are born and bred in the tenement and suffer from all its limitations.

4. The mental environment is artificial under all these conditions and in northern climates the limitations caused by six months or more of our modern housing have produced and will produce a type which as Creighton Browne says, "are distinctly more jumpy than we used to be."

5. My observations and the teachings of psychology based on physiology make it apparent that with the absence of a Nature environment at a time when the special senses are absolutely normal in their ability to receive impressions the growth of mind, based upon artificial environment will make it more difficult for each succeeding urban generation to wish to get back or to absorb normal even were the wish present, those elementary impressions, which are still the underlying basis of the thoughts of the modern generation. Whether or not modern social processes will develop their physiological or pathological immunizing changes need the new life conditions being so rapidly developed under modern peace and war times, as regards urbanization, inventions and artificial products of every sort must remain to the future for proof. Meantime the degeneration of tissue or the wearing-out process has become statistically recognized even in slow-going England, while every hospital, sanatorium, asylum, refuge and "home" and their class is ever increasing—is filled with the casualties due to this modern war against normal natural processes.

The following table showing the growth of hospitals and patients in Ontario is both instructive and hortatory:

	Total Hospitals in Ontario	Total Patients	Total Population of Province	Ratio of Patients in Population
1880	12	5237	1,926,922	1 in 369
1890	24	10523	2,114,321	1 in 200
1900	52	29761	2,189,947	1 in 72
1908	69	46971	2,280,459	1 in 48
1910	79	53692	2,523,274	1 in 47
1915	91	85759	2,598,320	1 in 30

If by artificial methods we may greatly limit tuberculosis we still shall have a problem of feeblemindedness to attack, which will for an unknown period under modern life conditions give our legislators educationalists, clerics and physicians ample occupation, if they are to solve the problem satisfactorily.

POLIOMYELITIS (INFANTILE PARALYSIS)

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IN VIEW of the present outbreak of infantile paralysis (poliomyelitis) in New York City the following discussion of the etiology and epidemiology of this disease is taken from Hygienic Laboratory Bulletin No. 90, with some revision by the author. This discussion, based on an extensive review of the literature and on the author's personal studies of the epidemics previously reported, is presented as a summary of the present knowledge concerning the cause and transmission of poliomyelitis, with such opinions as seem justified by the facts.

The essential facts brought out by the experimental studies of poliomyelitis are the following:

The specific cause of poliomyelitis is a minute microorganism, a so-called virus, capable of cultivation in vitro on suitable media.

The virus derived from human cases is pathogenic for apes, producing in them characteristic effects essentially similar to those produced in man. As is the case with many other pathogenic organisms, considerable variations in virulence are noted.

The only animals other than apes which have been found definitely susceptible to the infection are rabbits. The susceptibility of these animals to the infection appears highly inconstant, and the effects produced are both clinically and anatomically quite different from those produced in monkeys. Romer has found guinea pigs susceptible to an infectious paralytic disease strikingly similar to poliomyelitis, and Neustaedter has recently made observations suggesting that the guinea pig may at times be susceptible to poliomyelitis.

In the human body the virus has been found: (a) In the tissues and secretions of persons dead of poliomyelitis, namely, in the brain, the spinal cord, the mesenteric glands, the tonsils, and in the mucous secretions of the naso-pharynx, the trachea, and the intestines, (b) In the secretions of persons acutely ill with poliomyelitis, namely, in the naso-pharyngeal secretions and in washings from the rectum.

The infectivity of these secretions has been demonstrated not only in persons suffering from the clinically typical paralytic forms of poliomyelitis, but also, though less conclusively, in the secretions of those suffering from mild, clinically indefinite, abortive forms.

(c) In the naso-pharyngeal and intestinal secretions of persons convalescent from acute attacks of poliomyelitis. Although the total number of recorded examinations of convalescents is as yet small, the results of studies by Kling, Wernstedt, and Petterson suggest that in a very large proportion of persons recovering from poliomyelitis these secretions remain infective for several weeks or even months.

(d) In the naso-pharyneal secretions of apparently well persons who have been more or less intimately associated with other persons suffering from poliomyelitis, chiefly in epidemic foci. No figures are available as yet to form an estimate of the proportion of persons who, upon exposure to infection with poliomyelitis, become "carriers," or of the relative proportions of carriers and clinically recognizable cases of poliomyelitis in an epidemic focus. The technical difficulties in the way of demonstrating the virus, involving the injection of filtrates into monkeys, are such that extensive statistics upon this point can hardly be expected in the near future, unless the technique of the demonstration can be greatly simplified.

Outside of the human body the living virus has been demonstrated in nature only in the dust of rooms occupied by poliomyelitis patients and presumably contaminated with their secretions, and possibly (though the demonstration is not fully convincing) upon articles recently handled by persons suffering from poliomyelitis.

In brief, there is at present experimental proof of the following sources of infection: The secretions of persons ill with poliomyelitis, those convalescent from the infection, and "passive carriers"—that is, persons apparently well who

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are harboring the specific virus and discharging it in their secretions.

As to the avenues through which the virus may enter the human body to cause infection, inferences may be drawn chiefly from experiments upon lower animals. Monkeys may be experimentally infected by injection of the virus directly into the brain, or the subdural space, into the general circulation, the peritoneal cavity, or even the subcutaneous tissue. They may also be infected by rubbing the virus upon the scarified mucous membrane of the nose, and even by rubbing it upon the uninjured mucous membrane. Also, by the use of massive doses of the virus and under quite artificial conditions, it has been found possible to produce infection by feeding monkeys through a stomach tube.

Of the various methods of infection experimentally shown to be possible, infection through the nasal mucosa appears to be the most constant under conditions which might be expected to be approximated in nature.

Concerning the natural vehicles of infection, experiments performed under laboratory conditions are necessarily somewhat inconclusive. The infectiousness of the nasopharyngeal and intestinal secretions of infected persons and the susceptibility of monkeys to infection through the nasal mucosa indicate very strongly that the disease may be transmited in nature by such vehicles as may serve to transmit these secretions from infected persons to the respiratory (or digestive) tracts of others—that is, by more or less direct personal contact. The resistance of the virus to the influence of drying and sunlight suggests the probability of the infective agent being conveyed in dust and in fomites, a suggestion strengthened by the experimental evidence of the infectivity of dust from the sick room.

Experiments showing the possibility of transmitting the infection from monkey to monkey through the agency of a biting fly, Stomoxys calcitrans, and in one instance through the bedbug, have added considerable weight to the hypothesis that poliomyelitis is in nature an insect-borne disease. However, since the transmission of the disease through these insects has proven possible in only isolated instances and under highly artificial conditions, these experiments do not warrant the conclusion that stomoxys or other insects play any important part in the natural dissemination of the disease in man.

On the whole, the experimental evidence, taken alone, while not excluding other means of transmission, points to the conclusion that poliomyelitis is a contagious disease, spread from person to person through interchange of infectious secretions, the sources of infection being the clinically definite and clinically indefinite acute cases of poliomyelitis, convalescents, and passive human carriers.

To give the epidemiological characteristics of poliomyelitis in general terms is difficult, not only because of the wide variations noted in different epidemics, but also by reason of the comparative paucity of statistics affording but a slender basis for generalization. Still, making due allowance for numerous minor exceptions which can not be noted in a brief discussion, certain general epidemiological characteristics stand out as fairly well established.

1. Geographic distribution.—Poliomyelitis is, even in the light of our admittedly imperfect statistics, known to be of practically world-wide distribution. Without attempting to enumerate the localities from which it has been reported, the following examples of localities where epidemics have occurred in recent years may serve to illustrate how far the occurence of epidemics must be independent of such special climatic or other conditions as are peculiar to any restricted part of the globe.

Since 1905 epidemics have occurred in Europe from Scandinavia to the Mediterranean, from the British Isles to the Danube, in North America from Alaska to Alabama, throughout the breadth of the continent; in the West Indies; in South America; in Australia, and in the South Sea Islands. Thus the disease has occurred in more or less extensive outbreaks in both Eastern and Western Hemispheres under extremes of latitude from the Equator to the northern Temperate Zone. It is noteworthy, however, that the most extensive outbreaks recorded have been in the northern portions of Europe and in the northern section of the United States,

and Canada. The southern sections both of Europe and the United States, while not immune, have suffered less severely.

2. Seasonal prevalence.—In respect to season as to climate, poliomyelitis occurs under widely varying conditions. In the latitude of the northern United States cases have occurred, during the last few years, in every month of the year. Nevertheless the disease has a very distinctly characteristic seasonal prevalence, very constantly reaching its maximum both of sporadic and epidemic prevalence during the summer and autumn months, usually during the late summer and early autumn, and declining markedly during the late fall and early winter, to reach its lowest prevalence in midwinter and spring. In the Southern Hemisphere the disease reaches its maximum prevalence from December to May, the months corresponding to the summer and autumn of northern latitudes. On the Pacific coast of the United States, where the difference between summer and winter is more in the matter of rainfall than of temperature, poliomyelitis has occurred mostly during the dry summer season.

On the whole this seasonal prevalence may be accepted as one of the most constant characteristics of the disease. In respect to the season of maximum prevalence poliomyelitis is in contrast with the more common diseases generally believed to be transmitted by direct contact and to find access to the body through the respiratory tract, such as scarlet fever, measles, diphtheria, whooping cough, etc., which usually reach their highest prevalence in the autumn, winter and spring. In this respect, its seasonal prevalence, the disease more closely resembles infections of the digestive tract and diseases transmitted by such insects as are most prevalent in summer.

3. Sporadic and epidemic occurrence.—Poliomyelitis may be considered to have been endemic, for a considerable number of years at least, in the United States and Europe. Although the statistics are very fragmentary, it would seem a conservative statement that cases now occur every year in every State, and probably in every large city of the United States. Also, at least as regards the large cities, these is good reason to believe that this has been true for a number of years, since long before the disease began to attract attention by its occasional occurence in epidemics.

This fact is of importance as indicating that the recent epidemics can not be ascribed to the introduction of a new infection, and that there probably are scattered throughout the country reservoirs of infection, capable of giving rise to the widely scattered so-called sporadic cases.

4. General characteristics of epidemics.—In undertaking any generalizations upon the characteristics of epidemics of poliomyelitis, it must be emphasized that to almost any broad general statements there are numerous exceptions, since epidemics vary most strikingly. For example, between the outbreak reported from Hancock County, Iowa, and that in Cincinnati, Ohio, are such radical differences as might be expected between epidemics of two essentially different diseases. Yet, with due regard to the exceptions, the following are believed to be, in general, the essential characteristics of epidemic outbreaks of poliomyelitis, as shown by numerous studies.

(a) Irregular geographic distribution of epidemic foci.—Almost if not all epidemic diseases affecting man, even those transmitted chiefly from the lower animals or through insects, are disseminated by travel and traffic, and, in their spread from a given point, are naturally expected to follow the chief routes of traffic. It has, however, been noted of epidemics of poliomyelitis that they are often, if not usually, of irregular occurrence, not showing the distribution which would be expected as the result of dissemination along the main highways of traffic.

For example, the epidemic of 1907 in and around New York City, while it apparently extended north into New England, did not extend south to the nearby and intimately connected city of Philadelphia, nor west to the large cities in close communication with New York. The more recent epidemics of 1908, 1909, and 1910, in Minnesota, Nebraska, Iowa, and Kansas, are commonly, and perhaps justly, regarded as sequelae of the epidemic of 1907 in New York, yet up to this time no epidemic has been recognized in Chicago, through which passes practically

all the traffic from New York to the above-mentioned States. Again, in 1910, there occurred a rather severe epidemic in Washington, D.C., and a proportionately smaller outbreak in Philadelphia, while Baltimore, lying between these two cities, and in daily close communication with both, escaped without an epidemic—with at most only an increase in the number of endemic or sporadic cases. Numerous other instances might be cited where epidemics have failed to extend from a given focus to communities which appeared to be most intimately exposed and to offer equal opportunities for the spread of the infection. Such instances alone give the impression that epidemics may be due to a "place infection" not transferred by human travel—an infection of local water or food supplies, of insects or of domestic animals, whose range of travel is generally more restricted than that of man.

(b) Rapid spread over wide areas.—There are, however, other and almost equally numerous facts which argue against a "place infection' as the cause of epidemics, the chief of these being the rapid spread of epidemics over wide areas, as, for example, the spread over a whole State within a period of a few months. Of such rapid spread over wide areas of country there are numerous instances, in some of which it has appeared upon close study that the spread was in a general way radial from the earliest focus. This is illustrated by the course of the epidemic of 1910 in Iowa, and rather striking instances of similar rapid radial spread are given by Wickman in his account of the epidemic of 1905 in Sweden, and by Kling in his description of the Swedish epidemic of 1911. Such rapid spread over a large territory practically disproves the hypothesis that epidemic outbreaks are due to place infection independent of and not transferred by ordinary human traffic, since it is quite improbable that place infection of numerous localities within the same general territory should develop independently at the same time. The rapidity of spread has, too, in many instances, been such as to confirm the supposition that man, the most rapidly and widely travelling animal, is the carrier of infection.

Both in its rapid spread over large areas and in its irregularity, skipping localities to which it might logically be expected to extend, poliomyelitis finds an analogy in cerebrospinal meningitis, a disease which we now have excellent reasons to believe is directly contagious, being spread from person to person chiefly through the agency of passive human carriers. These characteristics, therefore, do not necessarily indicate insect transmission nor argue against the direct transmissibility of poliomyelitis.

(c) Small total incidence in the population affected.—Even during so-called epidemics, poliomyelitis has characteristically a small incidence in the total population. To be sure, instances are not wanting of epidemics in which a large proportion, over 1 per cent., of the total population has been attacked; but these are rather exceptional instances and are practically confined to outbreaks in small towns and small rural areas. In a large aggregation of people, such as the population of a city with over 100,000 inhabitants, a county, or a State, epidemics seldom attack more than one in a thousand of the population, often not more than one in two to four thousand. The incidence of poliomyelitis, therefore, even in epidemics, is frequently less than the usual annual incidence of several of the more common endemic infectious diseases in the same communities, and strikingly less than the incidence which these common diseases frequently attain during epidemics. Notwithstanding this small incidence in the population, epidemics of poliomyelitis are self-limited, invariably declining in any limited area, as a single city or county, within a few months, and as a general if not invariable rule not recurring in that locality for a period of at least two years. This characteristic decline of epidemics after only a very small proportion of the population has been attacked, appears not to be due to exhaustion of the sources or the vehicles of infection nor to be dependent altogether upon seasonal conditions. It is, in fact, difficult to account for on any hypothesis other than that of the exhaustion of susceptible material in the population.

(d) Incidence in rural and urban communities.—The recent occurrence of epi-

demics of poliomyelitis in so many countries, under such widely varying conditions, alike in tropical and frigid countries, in densely populated cities and in thinly settled remote country districts, has already been cited as showing conclusively that no set of conditions peculiar to any given locality is necessary for the development of an epidemic. It has, however, been observed as a very general rule that in small towns and in the country epidemics are more intense than in large cities, attacking a larger proportion of the population. This has been found true not only when individual small towns are compared with large cities, but also for groups of all the smaller towns or all the rural population of a State, compared with all the large cities in the same area. The proportionately greater rural prevalence has in fact been so constant as to be unmistakably due not to mere chance but to some fundamental law. It is to be remembered, however, that this applies to epidemics; whether or not the same is true of the endemic or sporadic occurrence of the disease is not fully established. Although the records of the Massachusetts State Board of Health relative to the prevalence of poliomyelitis in that State for five years would seem to indicate that the prevalence has been constantly greater throughout that time in the rural towns than in large cities, yet even there a large proportion of the cases reported each year have occurred in small epidemics scattered throughout the State rather than as sporadic cases.

In respect to its greater rural than urban prevalence, poliomyelitis has often been contrasted to such contagious diseases as measles and scarlet fever, which are quite constantly more prevalent in densely populated cities, and this contrast has been used as an argument against the contagiousness of poliomyelitis.

However, though the endemic prevalence of scarlet fever and measles is greater in large cities, data, which are as yet scant and incomplete, indicate that epidemics, even of these diseases, attain a higher incidence in the population of small towns and rural communities than in the population of large cities. Certainly it is true, at least of measues, that epidemics attain their greatest intensity in communities which have long been free from the infection; witness, for example, the devastating epidemics reported from the Faroe Islands and other remote communities. There is indeed ground for the view that the potential epidemic prevalence of a disease like measles is, in a measure, inversely proportional to its endemic prevalence. Therefore, in regard to poliomyelitis, the fact that epidemics reach a higher incidence in rural districts can not be taken by itself as indicating that rural conditions are necessarily more favorable for the spread of the infection. Before such a conclusion can justly be drawn it will be necessary to show that its endemic or sporadic occurrence is also constantly less in the large cities.

(e) Distribution among the various elements of the population in epidemic foci.—The close study of epidemics has shown that the incidence of poliomyelitis is proportionately about the same among persons living under good and those living under poor hygienic conditions. This practically eliminates from consideration as of great importance in the causation of the disease such factors as are intimately associated with poor hygienic conditions —such factors, for example, as insufficient and improper food, overcrowding, personal uncleanliness, and association with verminous insects.

No constant difference in regard to the incidence of poliomyelitis has been observed between the different races and nationalities constituting the population of areas where the disease has been epidemic. Nor has any constant relation been shown between the incidence of the infection and the topographic features of the various sections of the affected areas.

In one respect, however, poliomyelitis is constantly and very strikingly selective in its incidence, namely, in respect to age, its greatest incidence being always among children, especially those in the first half decade of life. Children under five years of age, constituting, in this country, from 9 to 12 per cent. of the total population, furnish usually from 50 to 90 per cent. of the cases of poliomyelitis. In some epidemics the disease is almost as prevalent proportionately in children between the ages of 5 and 15 as in those under 5 years of age, but adults

(those past the second decade), constituting usually over 50 per cent. of the total population, seldom furnish more than 10 per cent. of the cases, usually a very much smaller proportion. In the Buffalo epidemic of 1912 the incidence of poliomyelitis in children under 5 years of age was fifty times greater in proportion to their number than in persons from 5 to 24 years of age, while the whole population over 24 years of age, more than 50 per cent. of the total inhabitants of the city, remained entirely immune from attack.

As to the significance of this characteristic age incidence of poliomyelitis, its enormously greater incidence in children, it must indicate on the part of the children, either a generally greater exposure to the infective agent or else a greater susceptibility to its effects. So far as I am aware it has never been satisfactorily demonstrated that the children in any large epidemic focus were considerably more exposed to any probable source of infection than were the adults of the corresponding families. To be sure a number of suggestions have been made as to possible ways in which children might be generally more exposed to certain sources of infection than adults. For example, children drink milk more generally and more freely than do adults, but in every considerable epidemic of poliomyelitis of which I am aware, where the data collected have been sufficient, milk supplies could be quite definitely excluded as probable vehicles of infection. Moreover, milk-borne epidemics of other infectious diseases, as typhoid fever and scarlet fever, while characteriezd by a high rate of incidence in children, are not so strikingly—almost exclusively—confined to children as are epidemics of poliomyelitis. Even the proof that poliomyelitis is characteristically a milk-borne infection would not, therefore, offer an altogether satisfactory explanation of its very excessive incidence in children under 5 years of age and of the almost complete immunity of adults.

Again, on the hypothesis that poliomyelitis may be transmitted by biting insects, it has been suggested that children are more exposed to infection in this way because of their scantier summer clothing and their inability to ward off such insects as readily as do adults. It seems altogether improbable that these considerations are sufficient to account for an incidence fifty times greater in children than in young adults; and, as a matter of fact, epidemic diseases known to be transmitted by biting insects (yellow fever, bubonic plague, typhus fever) are not, in nonimmune populations, characteristically children's diseases.

It has also ben suggested that the infection may be commonly contracted from the dust of streets and dwellings, and that children, by reason of their habit of crawling and playing on the ground, are greatly more exposed to infection from this source than are adults. Especially as regards street dust it appears very doubtful that children, as a class, are greatly more exposed than adults, since the latter travel more widely over dusty streets. It certainly seems quite improbable that the exposure of children to dust infection is so enormously greater than that of adults as to account for the peculiar age incidence of poliomyelitis, assuming dust as the chief vehicle of infection.

Finally, because of their less cleanly and individualistic personal habits, children are probably more exposed than are adults to direct contagion through infectious secretions, yet experience teaches that contagious diseases in a nonimmunized, generally susceptible population are not disproportionately prevalent in children. As examples may be cited smallpox in unvaccinated communities, measles in new territory, typhoid fever in communities where contact is the chief factor in its spread.

On the whole it may be said that epidemiologic studies up to this time have failed to demonstrate greater exposure of children than of adults to the infective agent of poliomyelitis, and that the hypotheses put forward to explain an assumed greater exposure are not competent to explain it. The only hypothesis which appears to satisfactorily explain the enormously greater incidence among children is that they are, in general, more readily susceptible to the infection than are older persons.

Poliomyelitis uite commonly attacks both actually and proportionately more males than females. The disproportionate

incidence in males, fairly constant in all age groups, is commonly most striking in the ages above 15 years. This is the reverse of what would be expected in a disease transmitted chiefly by direct contact with the sick. Females over the age of 15, being more commonly in contact with the sick in the capacity of nurses, would be expected to develop the infection more frequently than males of the corresponding ages, and such is actually the case with scarlet fever and diphtheria. Since males of this age are more commonly out of doors and away from home than are females, the greater incidence of poliomyelitis among adult and adolescent males than females has very naturally suggested that the disease is usually contracted from some source other than the immediate environment of poliomyelitis patients, perhaps from some outdoor source, as from the soil, domestic animals, or outdoor insects. The greater incidence among males than among females is, however, not altogether incompatible with the view that the disease is really contagious, being transmitted usually through apparently healthy virus carriers. Males, whose business relations generally bring them into contact with more people, would theoretically have more chances of infection from carriers than females, and, assuming equal susceptibility, would more frequently develop the disease.

(f) Local sources and routes of infection.—Notwithstanding the minute care with which a considerable number of outbreaks of poliomyelitis have been studied, it has almost invariably been impossible to trace, with any degree of accuracy, the exact origin and routes of dissemination of the infection. Among the exceptions to this statement may be noted some of the small outbreaks described by Wickman, where it was possible to trace fairly definite lines of direct and indirect contact between cases; also a small outbreak, likewise reported by Wickman, where the evidence suggested that the infection had been spread through a common milk supply. These, however, are exceptional instances. In general the epidemiologic study of outbreaks has yielded only negative results. The very fact, however, that the results of study are usually negative has a certain significance.

For example, mass infection of common water and food supplies has been quite generally and definitely eliminated as a probable means of dissemination in the epidemics studied.

It has already been noted that it is usually impossible to trace any definite connection between the incidence of the disease and the immediate environmental conditions under which the various elements of the population live. This is rather strong evidence that the spread of infection is largely independent of such factors as overcrowding, improper feeding, personal uncleanliness, and the presence of vermin.

In a general way, the incidence of poliomyelitis in different communities has appeared to be roughly proportional to the number of domestic animals present. This is, however, perhaps only another method of stating that the disease has been commonly most prevalent in rural and semirural communities, where domestic animals are usually more numerous in proportion to the population than in large cities. There is no conclusive evidence of a characteristically greater incidence of infection among those persons who, by reason of their occupation or their residence, are most closely and intimately associated with domestic animals.

Domestic animals suffering from paralytic affections, clinically similar to poliomyelitis, have often been found in communities where poliomyelitis was epidemic but these animals have not appeared sufficient, either in numbers or in the intimacy of their association with cases of poliomyelitis, to account for the epidemics. Also, it has not been shown that the paralyses of animals are essentially similar to human poliomyelitis. Paralytic diseases of lower animals are not very uncommon, and though they have not been fully studied it appears that they may be due to a variety of causes. It is not even proven that such diseases are actually more common during epidemics of poliomyelitis is due to the fact that they are more apt to be noted and reported in communities where the epidemic prevalence of poliomyelitis has attracted attention to them.

Peculiar topographical or meteorological conditions can not be held to account

for epidemics, since, as already noted, the range of conditions under which epidemics have occurred is very wide. The unprecedented prevalence of poliomyelitis in certain sections of the United States in 1909 and 1910, during unusually dry seasons, gave considerable color to the hypothesis that deficient rainfall, with the consequent excessive prevalence of dust, was an important factor in the causation of epidemics, but broader experience has not confirmed this supposition. The fact that an epidemic of poliomyelitis may be declining in one community while in another, so near by as to be under approximately identical meteorological conditions, an epidemic may just be developing, is a further indication that the development and decline of epidemics are to a considerable extent independent of the weather conditions.

The evidence in regard to the contagiousness of poliomyelitis may be considered from two points of view: First, from the incidence of the disease among persons known to have been intimately associated with poliomyelitis patients, and second, from the proportion of recognized cases in which evidence could be obtained of association with previous cases.

The statistics presented in this report show that of 2,070 persons exposed to poliomyelitis by residence in the same house and same families as poliomyelitis patients, only 14 (0.6 per cent.) developed the disease in frank paralytic form. Even assuming that all of these actually contracted their infections from association with the sick members of their families, the contagiousness of poliomyelitis must still be very slight—less than one-fifteenth that of scarlet fever, as shown by Chapin's extensive statistics, compiled on a similar basis. The inclusion of abortive cases, which, though not developing paralysis, may be conservatively diagnosed as poliomyelitis, approximately doubles the apparent contagiousness, which is still further increased (to 3.2 per cent.) by the inclusion of less definite suspected cases. Yet, even including these indefinite suspicious cases, it is only in exceptional small outbreaks that the attack rate of poliomyelitis among exposed persons approximates that of scarlet fever or diphtheria. Similar evidence of the slight contagiousness of poliomyelitis has been afforded by its very small incidence among large groups of children exposed to contagion by association, in schools and institutions, with acute cases. The exceptions to this, as the outbreak reported in Hancock County, Iowa, and some small outbreaks reported by Wickman, do not invalidate the general truth of the statement, which is supported by a large mass of more or less definite observations reported by numerous observers from all parts of this country and Europe.

Taking up the evidence of contagiousness from the other point of view, namely, by attempting to trace cases back to association with previous cases, the statistics presented in this report agree with the observations made in most epidemics, that only a small proportion of cases can be ascribed to known contact with previous definite cases of poliomyelitis. Even including association with merely suspicious cases of illness, the majority of cases of poliomyelitis can not be traced to known contact, either direct or indirect, with any previous case. It is this apparent lack of relation between cases which has led so many investigators to seriously doubt or even deny the transmissibility of the disease.

On the whole it may be fairly definitely concluded that if poliomyelitis is transmissible from person to person through either the respiratory or the gastrointestinal excretions, it must be rather slightly or rarely transmissible, since the disease develops in such a small proportion of persons known to be intimately associated with acute cases. It also seems well established that the recognized cases of the disease must be relatively unimportant sources of infection. This follows necessarily, because a large proportion of the cases studied have been in persons not associated in any known way with previous recognized cases—often under circumstances which precluded the possibility of even indirect contact unless through the intervention of even indirect contact unless through the intervention of not one but a series of unrecognized carriers. In short, if poliomyelitis is a contagious disease confined to human beings, as certainly seems most probable at this time, the chief sources of infection must be cases

of illness not recognized as poliomyelitis, or, more probably, apparently healthy carriers of the virus.

(g) Evidence of transmission by insects.—Aside from the evidence that poliomyelitis may be transmitted experimentally from infected monkeys by biting insects (bedbugs and stable flies), and that the virus may be mechanically carried upon and in the bodies of common house flies, the evidence in favor of the view that the disease may be in nature insect-borne is based upon certain broad epidemiological peculiarities and the results of intensive study of local outbreaks.

The broad epidemiological peculiarities and the results of intensive study of local outbreaks.

The broad epidemiological peculiarities which at once sugest that some insect is a necessary agent in the transmission of poliomyelitis are a seasonal prevalence corresponding to the season of maximum prevalence and activity of numerous insects; greater intensity of epidemics in rural than in urban communities; and the irregular spread of epidemics, suggesting that some local factor as yet unrecognized must be present in order that an epidemic may develop.

The insects which can merit consideration as necessary or even important factors in the transmission of poliomyelitis may be expected to exhibit the following characteristics:

Distribution over an approximately world-wide territory.

Maximum prevalence and activity during the late summer and fall months, but in the North Temperate latitudes a certain though diminished prevalence and activity throughout the year.

Prevalence in large cities, small towns and rural districts.

Comparatively uniform distribution among the various social strata, among persons living under good and those living under poor hygienic conditions.

As to the seasonal prevalence of poliomyelitis, it is not so definitely limited to the warmer months as would be expected if the disease is transmitted by some outdoor insect; such as mosquitoes or biting flies. It has certainly not the sharply defined seasonale prevalence of yellow fever. On the other hand, it has a more sharply defined summer and autumn prevalence than would be expected in a disease transmitted by insects more strictly parasitic to man, as bedbugs, lice, and fleas. Typhus fever transmitted by the louse is rather a winter than a summer disease, and bubonic plague transmitted by fleas is by no means limited in its prevalence to the warm seasons.

As noted elsewhere in this report and in previous publications, the seasonal prevalence of poliomyelitis corresponds in a general way to that of typhoid fever, especially to that of rural typhoid and the "residual" typhoid of cities with good water supplies; and even more closely to the seasonal prevalence of infantile diarrhea and enteritis. Therefore, while the seasonal prevalence of poliomyelitis is markedly dissimilar to that of most so-called contagious diseases believed to be respiratory infections, it is at least as nearly like that of digestive-tract infections as of any known insect-borne disease.

The greater rural than urban intensity of epidemics of poliomyelitis has already been discussed, and mention made of the fact that the data now available do not prove the existence of more favorable conditions for the spread of infection in rural communities; they may even be interpreted as indicating a lesser rate of endemic prevalence in the latter than in large cities.

The fact that the most careful study of discrete outbreaks has often failed to discover any avenues of contact between cases has suggested to a number of students of the subject that the infection was disseminated through insects capable of travelling or being carried for considerable distances. The assumption that insect transmission offers any explanation of the scattering rather than grouping of cases is of doubtful validity, contradicted rather than supported by actual observation of epidemic diseases known to be transmitted by insects. Certainly the grouping of cases in close proximity to each other or their association with some definite focus is quite characteristic of epidemics of yellow fever, typhus, bubonic plague, and fly-borne epidemics of typhoid fever. The travelling habits of the stable fly might appear to account for

the occurrence of cases of poliomyelitis in persons at a considerable distance from the original source of infection, but even so it would be expected that if this were the usual method of transmission cases would be more grouped in localities where these flies are strikingly abundant, as in the vicinity of large stables, and that infection would be noticeably common in persons whose occupation greatly exposes them to the bites of stomoxys, as teamsters and hostlers.

Again, two facts which fail utterly of explanation by the theory of insect transmission per se are the small total incidence of poliomyelitis, and more especially its preponderating incidence in children. Diseases known to be insect-borne are not characteristically more prevalent in children than in adults, nor is there any obvious reason why they should be unless children are more susceptible to the infection. The hypothesis of insect transmission, therefore, like that of transmission by direct contagion, leads back to the assumption of general immunity to the infection on the part of adults and to unrecognized sources of infection.

On the whole, while there is much to suggest that poliomyelitis is insect borne, its epidemiology appears to be equally well explained on the theory of direct transmissibility through infectious secretions, and the latter theory is at present supported by more experimental evidence than is the theory of insect transmission.

Summary.

Reviewing briefly the data and considerations which have been discussed, poliomyelitis is due to a specific infective agent of which the only demonstrated natural sources are infected human beings, who may be divided into the following groups: The recognized sick, convalescents, the sick not recognizable as poliomyelitis cases, and passive virus carriers apparently in good health. The infective agent is known to be discharged from these sources in the excretions of the respiratory and digestive tracts; it is known to be fairly resistant to the destructive agencies encountered in nature outside of the human body. Perhaps the most significant fact in regard to the experimental transmission of poliomyelitis to monkeys is that they may be infected by rubbing the virus on the nasal mucous membrane. Infection through the digestive tract or through the agency of biting insects has been found more difficult and less constant.

The disease is, in nature, of widespread though rare sporadic or endemic occurrence. In epidemics it has occurred in recent years over a large part of the world the outbreaks being sometimes discrete, at other times spreading rapidly, but irregularly, over wide areas. Such epidemics characteristically run a rather rapid course in a given community, declining after a few months or less, after having attacked (so far as is evident) only a small proportion of the total inhabitants, usually not more than one in a thousand; and do not recur in the same locality for a period of at least two years. In epidemic foci children under 5 are attacked much more often than are older persons, the whole adult population remaining virtually immune in some epidemics.

The rapid spread of epidemics over wide areas, their spontaneous decline after only a small proportion of the inhabitants have been attacked, and above all the preponderating incidence in young children have not been satisfactorily explained by any hypothesis other than that the infective agent, during epidemics, is widespread, reaching a large proportion of the population, but only occasionally finding a susceptible individual, usually a young person, in whom it produces characteristic morbid effects. Assuming this rare susceptibility, the well-established facts collected by epidemiologic studies are compatible with the evidence of laboratory experiments that the disease is directly transmissible from person to person.

As to what constitutes susceptibility or the converse — immunity — practically nothing can be deduced except that age is obviously a factor of importance, susceptibility being generally greatest in the first half decade of life, thereafter progressively diminishing until in adult life there is a very general immunity to natural infection. The reason for this is at present a matter of speculation. Conceivably the greater immunity of adults may be due to a nonspecific resistance, developing naturally with maturity.

THE CARE OF CHILDREN UNDER SCHOOL AGE

By David Forsyth, M.D., D.Sc., F.R.C.P.

IT IS COMMON knowledge that the State medical inspection of children, organized some six years ago, has disclosed a widespread condition of ill-health even among the youngest school entrants. Indeed the very first year's experience, as summarized in the annual report of the Board of Education, shattered, once for all, the pleasing fiction that our educational portals were opened to troops of healthy, sturdy children. On the contrary it established the disquieting fact that disease had already laid a heavy hand on a very great number of them. It proved that a large proportion of the oncoming generation was already physically deteriorated at five years old. To give a single illustration. Some 7,500 London children in the infants' departments of the schools were medically examined; more than 5,000 of them were found with teeth already decayed, and, in addition, upwards of 2,000 defects of the nose and throat (mostly adenoids and enlarged tonsils) 600 of the ears and hearing, 450 of the eyes and sight, as well as some 600 other defects of various kinds, made up a catalogue which shocked everyone who was concerned for the national physique.

These results were echoed from all parts of the Kingdom and soon the question was being asked, What must be the early conditions of the life of these children that so few escape unharmed? Only yesterday the State had taken the momentous step of looking after the health of school children, and now another development, no less momentous, seemed about to be thrust on us. For, to put the matter on no higher plane than that of economy, how could the State continue to bear the heavy outlay of detecting and remedying the ill-health of tens of thousands of school entrants, if the less costly plan was to take these cases in hand earlier, when their treatment would be shorter and therefore cheaper and would allow a better chance of cure without any permanent disability? To some it even seemed that the real need was of measures not merely to cure these early defects, but to prevent them in the first instance. During —the past year or so, therefore, interest in child-welfare has gradually turned to children under school age—that is to the period of infancy which is the subject of discussion this morning.

Many pregnant questions suggest themselves. What, for example, are the circumstances favoring this deterioration in the first five years? What conditions are lacking which make for health? Are the roots of all this sickness to be traced back to soon after birth—possibly even earlier? If not, when does the tide of disease begin to rise? These are some of the questions which now have to be answered. But enlightenment on these points was obscured by the want of any previous systematic study of the child population as a whole during its first five years, and little was known of its conditions of health. Not, of course, that the whole of this period had been overlooked. One of the earlier phases of the modern movement on behalf of children was inspired by those grim tables in the Registrar-General's reports showing that something like 5 per cent. of the babies born in this country died before their first birthday; and, as you know, it was to effect a reduction in this mortality that "infant consultations," where babies are kept under regular supervision, were organized in many parts. But just as the Registrar-General's table focused attention on the first year of life, so these infant consultations piloted their charges only so far as their first birthday. Beyond that, all was dark, and nothing more was seen of them until, as school entrants, they took shelter under the Education Authorities—now, however, bearing unmistakeable testimony of hardships and rough weather. Precisely what had happened in the interval can only be conjectured, though this much, at any rate, seemed probable, that the physical defects accounting for most of the ill-health of the school entrants were

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scarcely to be found among the consultation babies.

This was the stage when the City of Westminster Health Society broke new ground by opening a centre for the continuous medical supervision of children from birth to school age.

This centre, now in its third year, throws some light on the physical deterioration of children under school age. I do not wish to inflict statistics on you, but the following table gives succinctly the results of my examination of the first 660 children who attended the centre.

Age of child	0—1	1—2	2—3	3—4	4—5 years	
Numbers exam'd	294	119	120	79	52	
Decayed teeth	—	1.7	16.7	45.6	55.8	per cent.
Enlarged tonsils	—	6.7	21.7	27.8	30.8	"
Adenoids	3.0	8.4	20.0	39.2	48.0	"
Rickets	19.0	24.4	8.3	5.0	1.9	"

It will be seen that the large majority of children under one year were healthy; of those who were not the greater number were suffering from errors in diet. In contrast to this, only a minority in their fifth year were without at least one physical defect.

Now it would be rash to assume, and I do not wish you to conclude that these results, based on a few hundred children, are an exact index to the condition of the whole infant population under school age, but there is this good reason for believing that our Westminster children are neither much better nor much worse than others elsewhere, namely, that the amount of ill-health that we have found in the first five years leads up to and accords fairly well with the amount that is known to exist in the sixth year among school entrants all over the country. On the whole, therefore, I feel I shall not be guilty of any overstatement when I reaffirm the opinion I expressed a year ago that "large numbers of children, healthy in all respects at birth, become within five years the physically defective entrants whom the Education Authorities are required, at no small cost, to restore as far as possible to their original state of health."

II.

To what causes is this deterioration to be attributed? First among them must be reckoned—since growth is one of the most important phenomena of childhood—the food provided for these growing children. If only mothers would suckle their offspring, this question would become insignificant as a cause of illhealth, but unfortunately hand-feeding is the choice in a great number of cases. In a very few of these no doubt the mother is physically unfit to supply breast-milk, either because none is produced in her breasts or because her own health, enfeebled by disease, cannot support this extra strain, but most often the choice is made either because the mother's work keeps her from her baby, or because her better judgment is overborne by the assertive claims put forward on behalf of this or that proprietary food. But these foods are rarely inexpensive, and sooner or later most of these mothers fall back on cow's milk, never realizing, it must be supposed, how deadly a food it can be, especially in the poorer parts of large towns. A considerable proportion of the daily supply is tuberculous, more still is contaminated by dirt, while, before reaching the customers' hands, it may or may not elude the cream-separator and the water-tap. Even after having been retailed it runs the risk of domestic contamination by flies and dust. Small wonder that the experience of a large city like Liverpool goes to show that 300 out of every thousand artificially fed babies under three months die of summer diarrhoea, as compared with 20 out of every thousand that are breast-fed.

Other important general factors in producing deterioration are want of fresh air and lack of exercise, neither of which is unfamiliar in the life of the town-bred child. A still more important factor, however, is want of cleanliness. I shall refer later to insanitation, and here would explain that by cleanliness I do not imply merely keeping the surface of the body clean, but in addition keeping clean the orifices of the body, especially the mouth and nose. This latter care is hardly the less important of the two, if disease is to be prevented, since the relatively tough skin is a better protection against para-

sitic bacteria than are the delicate membranes lining the mouth and nose, which moreover, being warm and moist, are eminently favorable to bacterial life. Yet how many mothers realize the importance, if colds in the head, sore throats and adenoids are to be prevented, of cleaning away with pledgets of wool the secretions that accumulate far back in the recesses of the nose in infants too young to use a handkerchief? Or the vital importance of keeping the teeth scrupulously clean, as the best and only preventive of dental caries? Perhaps these may sound small points, but it is the small things that count, and I am only stating the A B C of infant hygiene when I say that, with clean noses and clean mouths, physical deterioration with its accompanying ill-health and even worse would be materially reduced in the first five years of life. For adenoids and enlarged tonsils are not merely evils in themselves, but are the regular starting points of further troubles —deafness, discharging ears, dull-wittedness, deformities of the chest, meningitis, abscess of the brain, rheumatism and heart disease. Similarly, decayed teeth not only promote the growth of adenoids and enlarged tonsils, but open the door to tuberculous glands of the neck, anaemia, chronic indigestion and blood poisoning.

III.

It will be agreed that an infant encounters the earliest and most of the greatest dangers to his life within the four walls of his home. That the house, therefore, should be sanitary within, provided with ample air-space, a convenient supply of water, closet accommodation and cupboards for the clean storage of food; that its immediate surroundings should be sanitary, without the privy-middens, refuse heaps and unpaved yards from which disease-bearing flies and dirt are brought into the dwelling rooms; and that the food coming to the house, particularly cow's milk, should be clean, unadulterated and health-sustaining: these are all essentials of healthy infancy. Further, at no great distance should be trees and grass to freshen the air, give color and brightness to the neighborhood and incite to exercise and play.

Even this bare enumeration is enough to show that infant welfare is largely one aspect of the general social welfare. After all, children cannot but accept the parental environment, and as the standard of this is raised the average of infant health will be correspondingly improved. At the same time, however, it is not to be assumed that modern housing, up-to-date drainage, and enlightened town-planning will do all that is needed. They will effect a very great deal, but there still remains another factor hardly less important than all these put together. The mother is a mighty influence for good or evil. If she is enlightened she can turn these advantages to her children's benefits; but she can also fail to make the best use of them; and, worse still, she can neglect them until they actually grow to the danger of her children's health. A dirty living room, personal uncleanliness, improper food, and feeding utensils exposed to domestic contamination can soon destroy the health of a child even in a model house in a garden city. Therefore it is to the mother, her well-being, care and education, that we must look if her children are to be kept healthy. The maternal instinct, so often a thrice-blessed cloak for ignorance, though no doubt the best that Nature can offer for the progeny of animals, does not by itself satisfy civilized requirements. As a motive force it is indispensable, but it is a blind and unreasoning guide impelling mothers every day to acts of omission or commission which operate to the detriment, even to the fatal harm of their children. Yet the difficulty in so many cases, whatever the social class, is to induce a mother to question the infallibility of the instinct, to place herself outside her own feelings where she is free to distinguish the wish from the deed and its consequences.

I know no better way of effecting this than by ensuring that the facts of infant health are already impressed on her mind when the maternal instinct is first awakened. Only by teaching adolescent girls the rules and methods of infant rearing can the welfare of their future children be assured. These rules, once they are known, are so extraordinarily simple, and the least infraction of them carries so heavy a penalty, that, imparted at the

proper time and in the proper way, they can hardly be forgotten; and the emotions of maternity can only make them the more carefully heeded. Therefore, I submit that no reform is more pressing than the practical training of girls in their responsibilities as mothers.

It is necessary to add that it would be too foolish to attempt to train them, as has been suggested, by puting them to handle dolls? Yet where is the educational supply of live babies to be obtained? Whatever the coming improvement in the economic position of women, mothers will still have other duties than the immediate care of infants: there will be the general housework, the shop and industrial employment; and the hardships of children whose mothers go out to work have long been calling for redress. What then is to be done with infants when their mothers are engaged at work? These cases are so numerous in every district as to be satisfactorily dealt with only by collecting them in special day nurseries under the care of a staff of trained workers, a solution which offers the opportunity to obtain a supply of babies for the practical training of the older schoolgirls. Elementary schools are scattered over every district, being the more closely set the denser the population. If, therefore, day nurseries were opened close by the schools they would be within easy reach of the women workers of the district, and at the same time would be conveniently placed for the training of the senior girls in the adjoining schools.

This practical training, while relieving the present education of girls of the grave reproach that whatever else they are taught they learn nothing of the rearing of children, will also be the surest and quickest way to raise a standard of maternal public opinion which will make the existing conditions intolerable to the mothers themselves. But we must not expect it to produce a generation of maternal experts in infant hygiene. The average mother is never likely to be able to detect those earliest signs of disease which are most important from the point of view of cure, still less to apply to the individual child those general principles of prevention which alone can ensure its health. Yet now that the need of prevention or early cure is admitted, and with medical science in a position to supply this need in all but a small minority of cases, the time is ripe to organize medical services in the interests of the oncoming generation before as well as after birth.

It is, as we have seen, during the period before the child goes to school that the seeds of physical deterioration are sown which later grow into the ugly shapes of actual disease. While, therefore, it may be safely assumed that the dangers of this period will shrink to much smaller proportions when young mothers have already been taught as schoolgirls how to avoid them, nevertheless, since special medical advice is essential, children cannot be expected to arrive at schol age physically sound unless they have had the advantage of medical supervision throughout their earliest years. Medical inspection centres, therefore, are needed—comparable to those already known as infants' consultations, though not restricting their interest to babies under one year—where mothers can bring their children not so much to obtain facilities for the treatment of their defects (though provision for this must not be omitted) as to receive advice on preserving their health.

Schools of Infant Hygiene, Day Nurseries, and Medical Inspection Centres for both mothers and children are the chief items in the task now immediately ahead of us. The question of their organization and administration I must leave to those who have a better title than myself to speak on this aspect of the subject. Only this I would venture to suggest. These three organizations are very intimately related to each other. The Centres must necessarily be under medical control, and the Nurseries, with their collections of infants, highly susceptible to infectious diseases, could not be left without the same supervision. Further, all three would be dealing at the same time with the same mothers, the same children, and the same homes. It would seem, therefore, only desirable that nothing should be done to keep them altogether dissociated. On the contrary, having regard to both efficiency and economy, the best results could not be obtained without a fairly close working union between them. Finally, the work can be carried out successfully only

with the mediation of health visitors going in and out of the homes, partly to ensure that the medical instructions are carried out and partly to discover and help remedy any shortcomings which are detrimental to the children's wellbeing. I attach great importance to this side of the work since it can effect a great deal by way of introducing or maintaining in the home the standards and methods of the centres and nursery schools. In other words, I should like the homes of the children to be regarded as integral parts of any future developments, like so many local branches of the headquarters of the organization for the neighborhood.

IV.

It is in some such direction as this that the future improvements in the conditions of infancy seem to me destined to advance, and, I believe, to advance more rapidly in our generation than in any preceding it. The goal is the physical well-being of the children of the nation. A sufficiently inspiring aim which is in no way belittled if a doubt rises to the mind as to its finality. Why this attack on physical deterioration? Is bodily health alone worth striving for except as a stage to a further end? For a foal or a calf it is enough that it should grow into a healthy animal, but a child has a higher destiny. Without physical health his mind, temperament and individuality are liable to be warped and stunted, and only when the body is healthy has the individual the best chance of developing his nature. It is, surely, because of this that the prevention of physical deterioration establishes its claim on the best efforts of humanity.

And yet no great prophetic insight is needed to forecast that, as this vast amount of physical deterioration is gradually eliminated, there will be exposed to view an amount of preventable psychical deterioration every whit as widespread and deplorable, though at present, with but grudging interest given to the medical problems of the mind, it is almost entirely overlooked. But just as we have now learned to trace much of the physical ill-health of adults to the ignorant and wrongful treatment of their bodies in early childhood, so it will, I believe, be realized in course of time that, with the very large number of men and women who suffer from "nerves"—worries, anxieties, fears, self-depreciation and self-mistrust—their physical ill-health takes root in the earliest years of life when their fathers and mothers, knowing nothing of the prevention and early cure of psychical disorders, misused the impressionable emotions of their children with an ignorance profounder even than that with which many parents now regard the simple needs of their bodies.

FLIES AND REFUSE HEAPS

By W. H. Symons, M.D., D.P.H., F.I.C. Medical Officer of Health, City of Bath.

IN BATH for some years past we have distributed leaflets in the more crowded districts drawing attention to the danger from flies, and advising the early removal of refuse and the protection of food from contamination. Last year, in addition to posters and leaflets, I had a shop window placed at my disposal by the Women's Patriotic Club for the exhibition of posters, leaflets, and such other objects as I thought would be useful in preventing infant mortality, and in the month of May I started an exhibition on the same lines as that which was being started at the London Zoological Gardens under the direction of Professor H. Maxwell Lefroy, who called attention to borax as giving the most satisfactory results in fly prevention. Small amounts, such as 1¼ lbs. per eight bushels of manure destroyed 98 to 99 per cent. of the maggots, and he stated that borax kills the eggs as well as the larvae—0.62 lb. of borax in 2½ gallons of water per eight bushels, or 1 oz. of borax per cubic foot of manure.

The experiments upon which this statement was made were probably those recorded in a bulletin of the United States Department of Agriculture, No. 118, July 14th, 1914. The work appears to have been most carefully done under the direction of a professor of physiological chem-

*Abstract of a paper read at Provincial Sessional Meeting of the Royal Sanitary Institute, April 15th, 1915.

istry, an entomologist, and a mycologist. Experiments were tried with kerosene, kanut (KCl. Mg SO_4), pyroligenous acid, iron sulphate, carbolic acid, table salt, copper sulphate, lime sulphur mixture, potassium cyanide, Paris green, formaldehyde, sodium flouride, ammoniacal gas liquor, and calcium cyanide, but the most favorable results were obtained by the use of borax, which shows a larvicidal power of over 99 per cent. in nearly all trials. The experiments were started on September 13th, 1913, and examined for pupa on September 25th and October 6th. The results of these experiments and other scientific evidence were also published in a book issued by the Borax Consolidated, Ltd., under the title of Fighting the Fly Peril. I am also told by others that borax has been found most useful, but my own experiments with blow-flies and with the common house-fly have been most disappointing. As used by me in a saturated solution, i.e., half a pound to a gallon of water, borax does not seem to injuriously affect either the eggs or the larvae of the fly. I shall be glad to have the evidence of others, but I well remember borax being recommended as a means of exterminating the cockroach, an insect which is known to have dominated the insect world in the paleozoic period a million years ago. Many persons failed to obtain satisfactory results, and one person suggested that success depended upon pressing that aristocrat between two lumps of borax.

In my first experiments a weighted quantity of 25 lbs. of horse manure and straw litter was placed in each of three heaps on June 17th, the ground for one heap being prepared with 2 lbs. of powdered borax, two others were prepared with 2 lbs. of crude ammonium sulphate, and the fourth was a larger control heap on macadamized soil. Weighed quantities of 25 lbs. of manure were added to each heap every day or two. On one, a half gallon of saturated solution of borax was sprinkled; on the second, a pound of ammonium sulphate dissolved in half a gallon of water; on the third, one pound of dry ammonia sulphate was sifted; and on the fourth plain water was added in similar quantity. There were five lots added during the end of June and the beginning of July. These heaps were all under a lean-to roof near the public road, and adjoining the Bath Gas Works. Three heaps were, when finished, less than one cubic yard in extent; the control heap was larger. They were separated by stone buttresses, and were against walls facing east and south and shaded by buildings.

A thermometer was placed in a tube and passed down nearly to the bottom of each heap and kept there. I paid four or five visits a week and personally saw the lots of manure weighed and placed in position and noted the temperatures. There was not much variation between the temperatures of the heaps—the temperature at no time rose above 70 deg. C. (158 F.). The air temperature varied from 42.8 deg. to 75.3 deg. F., and the rainfall each week was 1.11, .73, .92, 1.84, .43, .89, 1.50, .08, .00 inch. I left them quiescent during August while I was away and had them turned over on September 1st, but could find no evidence of flies and no offensive odor, even after keeping samples a week in covered tins. The control heap was permeated by the mycelium of a mould, and superficially there were a good many cobwebs in all the heaps.

Thinking that possibly the vicinity of the gas works and a recently tarred road may have been obnoxious to the flies, I determined to repeat the experiments in my own garden, which is in the comparatively open country. The ground chosen was 170 feet above the sea level, on a plot of ground naturally sloping slightly eastward on the blue lias formation, but fairly level on the north, west and south. Above the rock on this plot of land there was a depth of 18 inches of Midford sand, which had been brought from the outcrop of this formation in south-east Bath, and above the sand a foot of loam and grass natural to Combe Park. This plot formed a portion of a tennis court prepared in 1905, and 260 feet from the public road. On Monday, September 13th, one ton of horse manure, which had been dropped during the preceding 36 hours, was brought from the corporation stables. Mechanical analysis showed that the manure contained about 25 per cent. of small straw, and on sun-drying in a glass-house it lost 52 per cent. of its weight. A mixed sample of 88 ounces was used for this analysis.

A large colony of flies accompanied the manure; most of them were the common

house-fly. The manure was carried from the cart in baskets, each lot being weighed and placed in one of four heaps. Three receptacles were formed of corrugated iron sheeting, the ground being first covered by half-inch mesh wire netting; but one heap was made in the open against a wall which protected it on the north.

Two experimental heaps were prepared, one with ammonium sulphate, the other with borax. For the first, one pound of dry ammonium sulphate was distributed over the ground from a sieve, and then 70 pounds of manure on which was sprinkled a solution of one pound of ammonium sulphate in half a gallon of water. Eight lots of manure were added in this way, making a heap of about 12 cubic feet; five cwt. of manure with ten pounds of ammonium sulphate, one pound being sifted over the top, and four gallons of water. The borax heap was prepared in the same way, but with a gallon of a saturated solution of borax added to each lot: a total of six pounds of borax and eight gallons of water to five cwt. of manure. This is about eight times the quantity of borax recommended for use by the Borax Consolidated Company, Limited.

A compo pipe was pushed into each heap, allowing the thermometer to rest about the middle of the heap, and a similar thermometer was suspended in the open air close by. The temperature of each heap was observed and noted two or three times a day the first few days, and almost daily up to November 16th, and at intervals after that. The usual meteorological readings were also taken in a Stevenson screen, and over and under the ground close to the heap—these readings are very similar to those which are taken in Central Bath and published in my annual report.

The temperature of the covered control was, at 1 p.m. on the 13th, 47 deg. C. At 7 p.m. it had risen to 70 deg. C., and kept near that temperature for 48 hours, but on the 16th the temperature was falling all day, and on the 17th was 55 deg. C.; on the 19th, 37 deg. C.; 20th, 29 deg., and on the 21st, 21 deg., or only three degrees above the external air. No higher temperature was registered until October 16th, when a secondary fermentation began, the temperature rose to 25 deg., going up to 28 deg. on the 29th, after that gradually falling to normal, which condition has been maintained. I have mentioned these temperatures somewhat in detail, because at a recent sessional meeting of the Royal Sanitary Institute one observer said he had seen heaps so heated as to be charred. In that case it must have been due to chemical action, while the temperatures I noted, being strictly limited to 70 deg., were due to bacterial fermentation; all insect life would be killed at 60 deg. C. (140 deg. F.). The rise of temperature was retarded in the other heaps probably owing to the presence of water, but on the third day all the heaps showed a temperature of 69 deg. or 70 deg. C. (158 deg. F.), after which the fall was gradual, and no secondary fermentation took place except in the covered control heap.

Mappin & Webb's fly-traps were placed in each heap, but the greatest number of flies caught after the first few days was five on September 27th, and three on September 30th; these were all the common house-fly. One fly was caught on October 5th, but after this date the heaps were forsaken.

Personally, I think there is little danger from a well-packed manure heap if it is not near milk or other food, but I do not think it wise to recommend the use of an open dustbin with recent food remnants for trapping flies, as advocated by C. Hurdstone Hardy in a lecture delivered at the congress of the South-Eastern Union of Scientific Societies at Brighton on July 4th last. The idea is scientifically correct, but could Mary Jane be relied upon to carry out her share in the experiment, and are we English so altruistically inclined as to always bear in mind our duties to our neighbors Might not the open dustbin be forgotten when rushing away for the August holiday? What a fine time the flies would have in visiting the residences of those who preferred September to August for holiday keeping.

Where manure is loosely packed and exposed to weather on the roof of a shed or in a yard, so that it may be partially freed from filth and used again in the stable, there is great danger to the public, and yet this practice is permitted in some towns, and you may see the manure so ex-

posed as you pass along public thoroughfares.

In a properly policed town a well-kept mews is generally free from flies. Motor cars are frequently kept near stables, and the odor of petrol is enough to keep the fastidious fly away. I had some difficulty in getting house-flies last year. The stable-fly, the green bottle blow-fly, and the lesser house-fly were common enough, but the domestic house-fly, which loves to travel to and fro from dung-heap to the dining room, was very scarce until August.

Incidentally I may say that it is quite easy to distinguish the ornamental, harmless fly from the deadly typhoid fly. The crucial test is, of course, the nervation of the wings, particularly observing that nervure which rejoices in the name "medio-cubital longitudinal nervure"; but for ordinary purposes it is sufficient to note the pose of the fly when at rest, the lesser house-fly folds her wings so that they overlap, the domestic house-fly keeps hers slightly inclined outwards. Then as regards sex; the male fly looks straight forward and his eyes are placed close together, while the female has a sly glance on both sides and her eyes are somewhat wide apart. The maggots of the house-fly are smooth; those of the lesser fly are more like a caterpillar with bristles.

In the present summer I think we should specially watch the tips of road sweepings. In past years these have commanded a ready sale, as they are rich in horse dung, but now the sweepings from main roads contain tar, and are unsuitable for gardens. The sweepings from the meaner streets contain no tar, but they may be rich in manure and in vegetable refuse. Separate heaps are kept at the tips, and the fly has a very great choice of climate; one portion of the tip may be actually in flames while another portion is covered with snow. The ideal way of disposing of road sweepings is by cremation at the destructor, and I am informed that this is actually done in some towns, but it must tax the capacity of the cells and add greatly to the labor and cost.

It seems scarcely necessary to completely burn road sweepings. It would, I think, be sufficient to char them, and I have thought that this might perhaps be done on a moving platform, travelling round in a vertical plane in the flue chamber of the destructor, and carrying the sweepings behind the cells, and throwing them off at the base of the main upshaft; but the fumes from the road sweepings would have to be completely burnt before passing into the shaft. I hope that engineers will give some attention to this problem. There is room for improvement in our methods of collecting house refuse. I shall not be satisfied until I see covered receptacles used for conveyance from the back yard to the destructor.

In considering the question of nuisances arising from refuse heaps too much importance is attached to what is called the direction of the prevailing wind. One has only to stand at the corner of the street for a short time and watch the smoke of various chimneys to see that the wind bloweth where it listeth, so it is very difficult to say where it comes from and where it goes; only the smoke from a tall chimney at least a hundred feet above the roadway can give any true idea of the direction of the wind, and this may be misleading as regards the properties of the wind. In considering climates, I use the absolute direction of the wind as determined from barometric observations by Buy's Ballots Law. Stand with the lower barometer on your left the wind will be going forward. But in considering nuisances, one has to pay attention to wind drift, not to wind direction at higher level. The direction of the wind at surface levels is determined by temperature; the cold air travels along the water courses and lies about in the valleys. The readings of grass thermometers are indications of this fact. With the cold air will also travel particles from refuse heaps, etc., and ultra-microscopic particles from refuse heaps, etc., and ultra-microscopic particles have an important bearing on disease. Personally I am inclined to regard the bacillus merely as the carrier of ultra-microscopic particles, and not as the prime factor in physiological action.

PROGRAM OF THE 5TH ANNUAL CONGRESS OF THE CANADIAN PUBLIC HEALTH ASSOCIATION

Quebec City—Sept. 13th and 14th, 1916.

Wednesday, Sept. 13th—City Hall.

10 a.m.—Registration of members.

11 a.m.—General business meeting; Report of Secretary; appointment of Committees.

12-15 p.m.—Departure from Quebec and Montmorency Ry. for lunch at Montmorency Falls.

Afternoon Session—City Hall.

2 p.m.—

1. Social investigations in relation to Public Health, Madame Gerin-Lajoie, Presidente, Federation Nationale Saint Jean Baptiste, Montreal.
2. The returned soldier and his problem—Dr. Thompson, M.P., Yukon Territory, Medical Superintendent, Military Hospitals Commission.
3. Modern sanitation in camps—Dr. J. W. S. McCullough, Medical Health Officer for Ontario, Toronto.
4. Improvement of milk supplies in small towns—Dr. John Hayes, Vice-President Sanitary Services, Province of Quebec, Richmond, P.Q.
5. Pollution of drinking water by untreated sewerage. M. Moc H. McCrady, Chemist, Quebec Provincial Board of Health.
6. Meat inspection—Dr. A. J. Hood, Chief, Department of Food Inspection, Montreal.
7. Notification of venereal diseases — Dr. P. V. Faucher, Professor, Laval University, Quebec.

Evening Session—Promotion Hall, Laval University.

8 p.m.—

1. Address of Welcome—H. E. Lavigueur, Esq., Mayor of Quebec.
2. Address by Sir Lomer Gouin, Premier Province of Quebec.
3. Address of President Canadian Public Health Association—Chas. J. Hastings, M.D., Medical Health Officer, Toronto.
4. A Federal Department of Health, by Michael Steele, M.P., South Perth, Ont.
5. De l'influence de la bacteriologie sur les developpements de l'hygiene moderne—Docteur Arthur Vallee, Professor a l'Universite Laval, Quebec.

Thursday, Sept. 14th—City Hall.

Morning Session—Symposium on Immigration.

9.30 a.m.—

1. Insanity and feeble-mindedness in immigrants—C. P. Clarke, M.D., Superintendent Toronto General Hospital, Dean Faculty of Medicine, Toronto University.
   Discussion: Dr. W. H. Hattie, Provincial Health Officer, Nova Scotia.
   Dr. Helen MacMurchy, Inspector of Auxiliary Classes of Ontario, Asst. Inspector of Asylums and Jails.
   Dr. G. S. Mundie, Faculty of Medicine, McGill University, Montreal.
2. Effectiveness of methods of inspection of Immigrants—Dr. J. D. Page, Chief Medical Officer, Port of Quebec.
   Discussion: Dr. P. H. Bryce, Chief Medical Officer, Department of the Interior, Ottawa.
   Dr. F. Montizambert, C.M.G., Director-General of Public Health, Ottawa.
3. Conserving the immigrants' resources —J. S. Woodsworth, Esq., Director, Bureau of Social Research, Governments of Manitoba, Saskatchewan and Alberta.
4. Civic problems caused by the immigrant—J. W. Shaver, Fort William, Ont.
5. The foreign immigrant as a Canadian citizen—M. M. Seymour, Commissioner of Health, Saskatchewan.

6. Title to be given later—Mrs. Burrington Ham, National Secretary Travellers' Aid and Immigration Committee of the Y.W.C.A., Quebec.
7. The tubercular immigrant in Canadian sanatoria—Dr. C. H. Laurin, House Surgeon, Immigration Hospital, Quebec.

Afternoon Session—City Hall.

2 p.m.—

1. Activated sludge treatment of sewage—H. W. Clarke, Chemist, Lawrence Experiment Station, Boston, Mass.
2. Modern conception of fumigation after communicable diseases—F. Adams, M.D., Acting Director of Laboratories, Department of Health, Toronto.
3. Difficulties of providing adequate water supplies for small and large towns—Dr. C. R. Paquin, Medical Health Officer, Quebec City.
4. Pre-natal care of mother—Dr. Jos. Gosselin, Asst. Medical Health Officer, Quebec City.
5. Value of milk depots (Gouttes de lait)—Madame Jules Tessier, Quebec.
6. Hygiene of children before school age—Dr. Rene Fortier, Professor, Laval University, Quebec.
7. Serum therapy—Professor Fitzgerald, Director Hygienic Laboratory, Toronto, and Dr. Defries, Provincial Health Laboratory, Ontario.

5 p.m.—

Business meeting—Election of officers.

Evening Session—City Hall.

8 p.m.—

1. Carriers of disease—Sir James Grant, K.C.M.G., Ottawa.
2. Economic value of preventive medicine—Ex-Controller McCarthy, Toronto.
3. Importance de l'Hygiene dans l'administration municipale—Dr. J. A. Beaudoin, Medicin Municipal, Lachine, P.Q.
4. The housing problem—Municipal records of house to house inspection—Dr. Emile Nadeau, Asst. Medical Supt. Immigration Hospital, Quebec.

Friday, Sept. 15th.

Excursion to Saguenay, with call at Grosse-Isle, Quarantine Station.

CANADIAN POETS

XXIX

ALAN SULLIVAN

The charm of his lucid and melodious verse has attracted wide and deep attention in Canada and the United States. A few of the titles are these: 'The Lover', 'Respice', 'To Sleep', 'Suppliant', 'When in the Speechless Night', 'The Call', and 'Came Those who saw and Loved Her' which is perhaps the poet's greatest achievement. In this poem he has reached a magnificent level. . . . . The apotheosis of honest toil is a golden thread running through much of Alan Sullivan's work. It is the dominant feature of his remarkable poem, 'The City.' . . . . It is the same attitude towards brawn and sinew which we find in his prose sketches, 'The Pilots of the Night,' and 'The Essence of Man.' . . . . He is always paying homage to the native and naked dignity of man. . . . While he is not in the usual sense a didactic author, he exhibits in his prose work and occasionally in his poetry, some characteristics of the social and moral philosopher.—J. E. Wetherell, B.A., in 'MacLean's Magazine.'

ALAN SULLIVAN has long had recognition in the United States, through his poems, short stories, and comprehensive articles on various themes, which have frequently appeared in Harper's Magazine, The Atlantic Monthly, and other leading American periodicals; but Canadians are only beginning, it seems to me, to realize his literary genius and fine workmanship. Recently I have read with critical interest most of his output, and am deeply impressed by his keenness of perception, his intellectual grasp, his power of sustained analysis, and by his native sense of the fitness of things. He is not only a poet of distinction, he is a writer of fiction of unusual excellence.

Edward Alan Sullivan was born in St. George's Rectory, Montreal, November 29th, 1868. He is the eldest son of the

late Bishop of Algoma, the Right Reverend Edward Sullivan, who was of Irish birth, and Frances Mary Renaud, a native of Scotland. In 1869, his father became Rector of Trinity Church, Chicago, and the family was resident there during the terrible conflagration which devastated that city in 1871. In his fifteenth year, he was sent to Loretto, a famous school for boys, in Musselburgh, Scotland, where he remained until his course of studies was completed. On his return to Canada, he attended the School of Practical Science, Toronto, and then engaged in railway exploration work in the West, and later in mining. He was assistant engineer in the Clergue enterprises at Sault Ste. Marie for a year and a half, before the organization of the Consolidated Lake Superior Company. Subsequently, he spent several years as a mining engineer in the Lake of the Woods district, during the period of its gold exploitation.

In December, 1900, Mr. Sullivan married Bessie Salisbury, daughter of Mr. George H. Hees, of Toronto, and their happy and beautiful home in Wychwood Park, Toronto, is now graced with four bright children, two boys and two girls.

In 1903, he became Mechanical Superintendent of Gutta Percha and Rubber, Limited, and held the position for ten years. He is now allied with a large number of Canadian electric light and power companies, and also devotes himself more fully to literary effort.

The following are his most important book publications:—*I Believe That*, 1912; *The Passing of Out—I—But and Other Tales*, 1913; and *Blantyre: Alien*, 1914.

SUPPLIANT

Grant me, dear Lord, the alchemy of toil,
  Clean days of labour, dreamless nights of rest,
And that which shall my weariness assoil,
  The sanctuary of one beloved breast:

Laughter of children, hope and thankful tears,
  Knowledge to yield, with valour to defend,
A faith immutable, and stedfast years
  That move unvexed to their mysterious end.

PROSPICE

The ancient and the lovely land
  Is sown with death; across the plain
Ungarnered now the orchards stand,
  The Maxim nestles in the grain,
The shrapnel spreads a stinging flail
  Where pallid nuns the cloister trod,
The airship spills her leaden hail;
  But—after all the battles—God.

Athwart the vineyard's ordered banks,
  Silent the red rent forms recline,
And from their stark and speechless ranks
  There flows a richer, ruddier wine;
While down the lane and through the wall
  The victors writhe upon the sod,
Nor heed the onward bugle call;
  But—after all the bugles—God.

By night the blazing cities flare
  Like mushroom torches in the sky;
The rocking ramparts tremble ere
  The sullen cannon boom reply,
And shattered is the temple spire,
  The vestment trampled on the clod,
And every altar black with fire;
  But—after all the altars—God.

And all the prizes we have won
  Are buried in a deadly dust;
The things we set our hearts upon
  Beneath the stricken earth are thrust;
Again the Savage greets the sun,
  Again his feet, with fury shod,
Across a world in anguish run;
  But—after all the anguish—God.

The grim campaign, the gun, the sword,
  The quick volcano from the sea,
The honor that reveres the word,
  The sacrifice, the agony—
These be our heritage and pride,
  Till the last despot kiss the rod,
And, with man's freedom purified,
  We mark—behind our triumph—God.

THE KITE

Upon the liquid tide of air
It swayed beside a dappled cloud;
It seemd athwart the sun to fare
Full of strong flight, as though endowed
With vibrant life. Buoyed in the sky
It swam, and hardly might the eye
Traverse the fields of ambient light
To scan its heaven aspiring height.
And, like a spider's web, there slipped
A pulsing earthward thread, that dipped
In tenuous line, that throbbed and spoke,
Down through the sunlight and the smoke
Down to a small and blackened brood
Of puny city waifs that stood,
And—lost to hunger, want or time—
Stared, rigid, through the city's grime
At the far envoy they had given
As hostage to the winds of heaven.

Thus may the Soul to heights elysian
Send argosies of dream and vision;
Send far flung messengers that rise
Strong pinioned, cleaving to the skies,
To float amid the poised spheres,
Beyond the tumult of the years,
Till—down the rare and rainbow line
That earthward trails from fields divine—
Shall pulse the throb of mystic wings
And faint, sweet, rapturous whisperings
Of incommunicable things.

CAME THOSE WHO SAW AND LOVED HER

Came those who saw and loved her,
    She was so fair to see!
No whit their homage moved her,
    So proud she was, so free;
But, ah, her soul was turning
With strange and mystic yearning,
With some divine discerning,
    Beyond them all—to me:

As light to lids that quiver
    Throughout a night forlorn,
She came—a royal giver—
    My temple to adorn;
And my soul rose to meet her,
To welcome her, to greet her,
To name, proclaim, her sweeter
    And dearer than the morn:

For her most rare devising
    Was mixed no common clay,
Nor earthly form, disguising
    Its frailty for a day;
But sun and shadow blended,
And fire and love descended
In one creation splendid
    Nor less superb than they:

. . . . .

You—of the finer moulding,
    You—of the clearer light,
Whose spirit life, unfolding,
    Illumed my spirit's night,
Stoop not to end my dreaming,
To stain the vision gleaming,
Or mar that glory, seeming
    Too high for touch or sight.

Dear as the viewless portal
    Of dream embroidered sleep,
Lift me to dreams immortal,
    Till, purified, I leap
To hear the distant thunder
Of dark veils rent asunder,
And lose myself in wonder
    At mysteries so deep.

Till, past the sombre meadows,
    Tearless and unafraid,
Linked even in the shadows,
    Our deathless souls have strayed;
And you, my soul's defender,
O valiant one and tender,
Cry out to God's own splendour,
    Behold the man I made!

THE CITY

Day leaped over the city wall
With one quick, sharp imperative call.
And, at the luminous touch of him,
The glow of a myriad lamps grew dim.
Life, like a question, seemed to creep
Where the shadows gathered black and deep,
Till, in the hush of the morning air,
Came the sigh of a multitude hidden there.
Then movement and murmur borne afar,
The grinding wheels of a hastening car,
And, sudden, the tide of humanity flowed
By lane and valley, by square and road
With the dogged hard inflexible tread
Of men that sweat for their daily bread.

The dusty city engulfed them all
That came at her fierce relentless call;
The shining engines trembled and stirred,
A thousand factories opened wide,
The lips of the lifting steam valves purred,
A thousand diligent wheels replied;
So jar and effort and clamor grew,
And toil that only the toiler knew.

The stream had slackened, but rose again
Fringed with a lesser breed of men,
Narrow shouldered and pale of face,
Soft-handed sons of a softened race,
Brushed and scented and combed and pressed,
Decked like the windows they daily dressed;
Children, old ere their childhood came,
Bent, to some hardened master's shame,
Robbed of the vision of childish mirth,
But wise from the sharing of work and dearth;
Youthful lawyers with anxious looks
Swinging bags and portentous books;
Last of all, in luxurious ease,
Trim stenographers, salesmen, clerks.
Bankers and brokers, and such as these,
In opulent motors that swiftly pass
With a flash of panels and polished glass.

The reeking city had room for all
Who came at her hard and dominant call,
Till the voice of her labor sounds aloud
Till streets are black with a turbulent crowd;
Crush and hurry and press and race
Till courtesy covers her burning face;
The battle is on—with brain and will,
The battle is on for the dollar bill;
The gods of the nation have turned to gold
And honor and love are bought and sold:
The gambler smiles as he juggles with fate,
And the greater is he whose gain is great;
The merchant smiles o'er the counter rails
At the profit he makes on his bargain sales;
The lawyer smiles, pleads a burglar off,
Forecloses a mortgage—and—goes to golf;
The banker smiles and the smile is wide
At the figures that show on the surplus side;
Wherever the smiles may come, they still
Are mostly based on the dollar bill.
The rich man wastes what the beggar needs,
The miser scowls while the widow pleads,
And little children with tender feet
Dodge death for pence in the roaring street.

The sun loomed large in the dusty air,
And tempered the fire of his noontide glare;
The voice of the clamorous whistles spoke,
And a hundred thousand toilers broke
From forge and factory; men forsook
Bench and counter, column and book
Till flagstones rang with the homeward tread
Of those that sweat for their daily bread.
Bent broad shoulders and tired eyes,
Blackened faces and weary hands,
Dull of hearing, but very wise
To mark necessity's stern commands:
Laborers all—but every one
Made in the image of God's dear Son.

Silence and echoes and lines of light,
Threading the quiet deserted street;
Empty buildings, and, then the height
Where changeless heaven and starlight meet;
The peace of darkness for laboring men,
And rest ere cometh their toil again,
For night crept over the city wall
And blessed sleep enveloped them all.

The Sanitary Inspectors' Association of Western Canada

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THE NECESSITY FOR FOOD INSPECTION

Read Before the Winnipeg Members by G. R. Mines, Associate R. San. Inst., Food Inspector, Winnipeg Health Department.

IN THESE DAYS of advanced sanitary knowledge but few people will be found to deny that food inspection is necessary, although we sometimes come across the old-fashioned individual who claims that people were just as healthy when there was no inspection. It is not possible to prove the contrary by actual statistics, because proof that disease in man is caused by eating the flesh of animals suffering from that disease is difficult to procure. For instance, in the case of a man developing tuberculosis, he may have contracted the disease by inhalation, by accidental inoculation with infectious material, or by the ingestion of tubercular milk or meat; then, again, a person may eat diseased meat and not be aware of it, and the disease may not develop for some little time, when it is not possible to trace the connection. It must also be admitted that large quantities of diseased meat have been eaten without harm, so far as is known; so that in just what relation the consumption of diseased meat stands as regards injury to health is not known. On the other hand we know that there are authentic cases of transmission of disease through meat. In Germany, in the year 1890, 109 people contracted anthrax through eating meat from animals affected with that disease, and 14 of these people died; in 1900 there were 62 cases with 10 fatalities. There are numerous cases on record of trichinosis caused through eating affected pork; one outbreak at Hettestadt caused 129 deaths out of 500 cases. There are also authentic cases of the cysticercus disease in man caused by eating pork infected with cysticercus cellulosae. Bollinger gathered data with regard to 40 outbreaks of meat poisoning, caused by eating meat of animals that underwent emergency slaughter, owing to disease or parturition, and in some cases veal from calves suffering from septic affections.

So we see that the possibility of transmission of disease by meat does exist. We also know that where systematic inspection is enforced there are but few cases of animal diseases occurring in man. In Germany, where so much raw and half-cooked pork is eaten, the cysticercus disease is almost unknown compared with fifty years ago, and as compared with countries where there is no inspection, such as Russia, Galicia and Roumania. By inspection, large quantities of diseased meat are every year removed from the market and destroyed, which otherwise would be consumed by the public, so that the inspection of meat must have a considerable effect on the health of a community. The chief aim of sanitary science is the prevention of disease, and surely the elimination of diseased food is a great step towards the fulfilment of that aim. Hygiene is not a new science by any means. Writings on health are among the oldest in the world, for the subject has engaged the attention of the profoundest thinkers. The fact that we find, in early history, restrictions placed on the use of certain articles of food, proves that there was a knowledge that harm might result from the consumption of such articles. Herodotus, a Greek historian, who lived 450 years B. C., tells us that the Egyptians were forbidden to eat pork for the reason that it produced an excess of humors and eruptions. The hydatid cyst is mentioned by early medical writers, and Aristotle, the Greek philosopher, speaks of examin-

ing the tongues of pigs to ascertain the presence of bladder worms. The Mosaic law forbade the slaughter of animals affected with wasting diseases and the consumption of unwholesome meat, carrion, or anything that had defects. Animals intended for sacrifice were required to be perfectly healthy, and furthermore they had to be certified by a mark on the horns, and death was the punishment for any priest sacrificing an animal not so certified. The Athenians were forbidden to eat the meat of a lamb which had not been shorn twice, and in early Greek history we find records of a system of market police who were entrusted with the proper conduct of the meat traffic. Mohammed, in the Koran, decreed a series of regulations concerning food materials in which he forbade the use of meat from animals which had died a natural death, or by accidental injury.

Thus we find the necessity for meat inspection recognized in the records of ancient races, and from that time down to the present day numerous laws have been passed regulating the meat and food traffic, and providing penalties for their infraction. Ostertag gives us some interesting information regarding the various German ordinances governing meat traffic, and we must admit that meat inspection in Germany has been brought to a high state of efficiency. The earliest German records in which traffic in meat is mentioned, are the articles of the City of Freiburg, in 1120, and in 1276 the regulations concerning butchers in the Augsburg charter, prescribed slaughter in a public slaughterhouse for cattle and sheep, and compulsory inspection and declaration of diseased meat—a standard of hygiene not reached by many cities today. In the 19th century we find other countries passing laws governing the meat and food traffic, but compulsory inspection in most cases only applies to meat intended for export trade.

Meat is the most important, as well as the most difficult, part of food inspection. The flesh of animals forms a large part of the food of most people, and yet the general public show considerable ignorance as to the wholesomeness of the meat they buy; not only so, but the consumer cannot sufficiently protect himself by private means, for there is no definite method of preparation by which the unwholesomeness attaching to meat, under certain conditions, may be removed, and reliable criterion as to its fitness for use can only be obtained by inspection. Furthermore, experience has shown that even in cases where it is possible, by observing certain precautions, to avoid the harmful effects of meat, the public is inclined to neglect the precautions. This is illustrated by parasitic diseases, preventable through thorough cooking, and yet the numerous epidemics of trichinosis, etc., have not sufficed to change the custom of eating half-cooked pork. There is also the danger of substitution by unscrupulous dealers of one kind of meat for another, such as horse flesh for beef, and goat flesh for mutton. For these reasons it is the duty of sanitary authorities to withhold from consumption all meat likely to injure health, and to see that the public is not imposed upon.

In this country there is little substitution of meat practised, the sale of horse flesh being forbidden, there is not the danger of its substitution for beef, as there is in European countries where the sale is legal under certain conditions, but our meat supply comes to us through so many different channels, large quantities being killed in abattoirs where there is no system of inspection, that the problem of maintaining a wholesome supply is a large one.

In our own city the large abattoirs have Government inspectors stationed on the premises, but this is mostly in the interests of the export trade, as no meat may be shipped out of the province without the Government certificate. Many animals are slaughtered in small abattoirs outside the city, without inspection, and the meat brought in for sale; and there are a number of butcher stores where the greater part of the meat offered for sale does not bear the Government stamp. In some restaurants uninspected meat is largely used, as cheapness is usually a great consideration, and it is in these cases that municipal inspection steps in and protects the public from consumption of meat that is not fit to be used.

The public has the right to a guarantee that the food supplied to them is pure and

wholesome, and in the case of meat this can only be given by the inspection of animals before and after slaughter. The establishment of public abattoirs, with competent inspectors attached, and compulsory slaughter and inspection in those abattoirs of all animals intended for human food, would greatly simplify the problem of guarding the city's meat supply.

Meat may be injurious to the consumer in several ways; it may be the means by which pathogenic organisms are introduced into the human body, as certain diseases are directly transmissible to man; it may contain the intermediate forms of parasites capable of developing in the human subject, and it may be very dangerous on account of the changes which occur in the flesh, caused by diseases not transmissible to man, or by the action of putrefactive bacteria. It is improbable that any butcher would try to sell meat from an animal which had been killed while in the last stages of disease, as the change in the appearance of the meat is so pronounced that the most ignorant person would hesitate to buy it, but in the earlier stages the change is so slight as to be unnoticeable to the average person, and yet the meat may be as noxious in the one case as in the other. The early stages of tuberculosis, trichina spiralis, and cysticerci produce little change in the appearance of the flesh and yet if it is eaten under certain conditions it is potent to cause disease in the person eating it. By certain conditions I mean if it is later half-cooked or in some of those preparations in which raw meat is used; for it must be understood that cooking, if carried on long enough at a high temperature, will destroy all pathogenic organisms, but we do not like our meat overdone, and it is seldom that the temperature in the inside of the joint is as great as on the outside. In experiments made by Professor Woodhead for the Royal Commission on Tuberculosis, he injected tuberculous material into the centre joints of meat and cooked them in the ordinary way, and he concluded that while the temperature was sufficient to destroy tubercular material on the outside of the joint it could not be relied upon to render the meat sterile.

Diseased meat may be doctored in some manner in order to hide evidence of disease. Most of us are acquainted with the practice of stripping beef—removing the pleura, or peritoneum, and with it the evidences of tuberculosis, and by this means turning a repulsive looking carcass into one that appears innocent of all harm. Carcasses of animals may be treated with preservatives which hinder decomposition on the outside but do not prevent putrefaction setting in in the deeper parts.

It is not my intention to speak of diseases of animals, but as showing the necessity for inspection it might be as well to notice the number of diseases which affect animals used for human food. The following occur in man as well as in animals: Anthrax, actinomycosis, foot and mouth disease, pox, rabies, tuberculosis. Those occurring in animals only: Pleuropneumonia, rinderpest, black-quarter, swine erysipela, hog cholera, parturient fever, septicaemia and pyaemia. The parasitic diseases, trichina spiralis, the hydatids of Taenia solium, T. echinococcus, T. saginata, and flukes all continue the cycle of their existence in man, and there are many organic diseases, and anomalies of the blood, which may render meat unfit for food, but they are too numerous to mention here. The last Dominion Government Report of the Meat Inspection Service mentions 60 diseases and conditions resulting from disease as the cause for condemnation of meat. 7,177 carcasses of cattle were condemned, of which 2,488, or more than a third, were tubercular, septicaemia accounted for 182, C. bovis 263, and pneumonia 118. In swine tuberculosis was responsible for 2,240 carcasses out of 4,007 condemned, septicaemia for 392, hog cholera 243, pneumonia 268 and C. cellulosae 217. Out of 399 sheep condemned, 66 were for septicaemia and 92 for pneumonia. Portions of other carcasses were condemned and of these by far the greater part was on account of tuberculosis.

By inspection before and after slaughter diseased meat can be kept from the market, but the danger from putrefying meat can only be met by a routine inspection of places where meat is offered for sale, or manufactured into some of the different preparations. Meat may leave

the abattoir perfectly good, but if it is kept under bad conditions, changes soon take place in the tissues, due to putrefactive bacteria, which are present everywhere, and which find a good medium in which to develop. Despite the fact that some people like game and mutton more or less high, all authorities agree that decomposing meat is a highly dangerous food. Our knowledge of food poisoning has increased greatly of recent years. Many cases, previously of mysterious origin, can now be explained by the action of the putrefactive bacteria, and the products they form by splitting up the proteid substances. The food may not show evident signs of putrefaction, and yet, if eaten, may produce symptoms of intestinal irritation, known as ptomaine poisoning.

In 1856 Panum demonstrated that the poison which occurs in putrefying meat is a chemical substance, and not a living organism, although it is formed by organisms, as he was able to boil it for eleven hours, and dry it at boiling heat, without destroying its poisonous properties.

Prepared meats offer to unscrupulous dealers a ready means of using animal flesh of doubtful quality, and if we consider the number of preparations on the market, and the large trade in them, we must admit the possibility of danger to health. Sausage, like charity, covers a multitude of sins, and once it is in its skin, it is difficult to recognize the nature of its contents; even the skin may be the intestine of a diseased animal. Especially is this true amongst the foreign portion of our population, on account of the use of garlic, which has the property of hiding any taint or smell the meat might have.

In some preparations the meat is only partially cooked; in others the blood and viscera are used, and apart from the fact that most diseases affect these parts of the animal, they decompose more quickly than the musculature, therefore it is imperative that they should be from healthy animals.

Under certain conditions other articles of our diet, such as milk, butter and cheese may transmit disease, or be unwholesome through the presence of putrefactive bacteria. Milk is largely used by everyone, and it forms the greater part of the diet of sick people and children; moreover it is used largely in a raw state, and it is highly important that it should be obtained from healthy cows, produced in such a manner as to reduce contamination to the minimum and delivered without addition to it, or abstraction from it.

At least three diseases, anthrax, tuberculosis and foot and mouth disease, are directly transmissible by milk, and it may also be the means by which other diseases, such as typhoid fever, diphtheria, and cholera, which do not affect animals, may be transmitted to man, the milk becoming infected in various ways after withdrawal from the udder. Bacteria of all kinds find milk a splendid medium in which to develop and yet they do not alter the appearance of the milk so that their presence may be detected by a physical examination.

Tuberculosis is the most common disease affecting cattle; it is the most important from a sanitary standpoint in its transmissibility to man by milk. Many instances are on record of cows, which appeared healthy, reacting to the tuberculin test, and, according to Walley, "the tubercle bacillus can be detected, not only in the lactiferous product of animals in whose udders tubercular lesions exist, but occasionally also in that product, when the gland, to all appearance, is perfectly healthy."

There is no doubt that the danger to the public from the ingestion of raw tubercular milk is much greater than that resulting from the consumption of imperfectly cooked tubercular meat. Tuberculosis can be produced in animals by feeding them milk from tubercular cows, and while it has not been proved that the bacillus in human and bovine tuberculosis is identical, all authorities agree that tubercular milk is a dangerous food, and liable to produce the disease in man.

There is not the same danger of milk from animals affected with anthrax or foot and mouth disease being used, as these diseases cause radical changes in the appearance of the milk, as well as in the appearance of the animal.

It has long been recognized that milk is an active agent in the dissemination of typhoid fever; this may occur through

the adulteration of milk with water to which the typhoid bacillus has gained access; through the using of similarly infected water for the washing of cans; or through the handling of utensils or milk by typhoid carriers, persons having the power of infecting others though showing no clinical symptoms of the disease. Milk may also cause intestinal trouble in children through the introduction of filth containing putrefactive bacteria at the time of milking; and in most cases where disease is spread by milk it is through uncleanliness of producer or seller.

Bacteriology has provided a way of escape from these dangers in pasteurization which if properly carried out, will destroy pathogenic bacteria which do not form spores, such as the tubercle and typhoid bacilli; but pasteurization will not render milk clean, neither is it compulsory, and the greater part of the milk used is in the raw state, so that it is only by thorough inspection of dairies, milk depots and their water supplies that the public can be safeguarded.

Next to milk, butter must also be looked upon as a vehicle through which infectious material may be distributed in a way that leads directly to the human stomach, and in a way that the individual has no means to protect himself. Tubercle bicilli have been found to exist in butter, and in greater concentration than in milk. It has also been proved by investigators that the bacilli were alive and virulent after 120 days (Dawson). The U. S. A. Bureau of Animal Industry inoculated guinea pigs with butter, made from infected milk, the butter being 99 days old, with the result that the animals developed generalized tuberculosis.

Canned goods are another part of our diet that requires inspection. All kinds of meat, fish, fruit and vegetables are preserved in cans, and these also may become unwholesome and dangerous to the consumer, unless the quality used is good and the canning properly done. The quality of the article can only be guaranteed by inspection at the factory, but a regular inspection of places where these goods are sold is requisite, for if the cans are defective, or the sterilization imperfect, putrefaction of the contents may not start until after the goods have left the factory and are on the grocer's shelves, and then they begin to show the typical bulging ends. Cans may rust from various causes and the rust may eat a small hole in the can, sufficient to let in the air and the bacteria ever present in it, with the consequent spoiling of the goods. These damaged goods are sold cheaply and are a constant source of trouble to the food inspector.

With regard to fruit and vegetables, while they are affected by a number of diseases, they are not dangerous to man, although rotten fruit has been the cause of diarrhoea in children. There is one danger in conection with lettuce, cress, celery, and such vegetables as are eaten raw, and that is they may be contaminated with the eggs of T. Echinococcus, a parasite common in dogs and capable of developing in the human subject. Cases of typhoid fever have been traced to the eating of cress, grown or washed in water containing typhoid bacilli, so that attention to cleanliness is as great an essential in handling or selling vegetables or fruit as in the case of foodstuffs.

In the case of other articles of food, the danger lies in the fact that they may be adulterated with substances more or less harmful to man. These adulterations may be for various purposes, such articles as benzoate of soda, boric and salicylic acid are used as preservatives, as they have the power of delaying fermentation and decay. All these chemicals have been proved injurious to health, and apart from that, their use enables unscrupulous manufacturers to use goods which may be unfit for use. Some adulterations are in the form of coloring matter, which may contain compounds of arsenic and copper, and although the amount used is small there is a certain amount of danger in their use. In other cases substances may be used which are neither harmful nor beneficial, but are put in merely to make weight or bulk. To avoid danger to health from these sources, samples of goods must be taken from time to time and submitted to chemical analysis.

Many laws have been enforced in past years relating to this subject. As long ago as 1203 A.D. in the reign of King John there was a proclamation enforcing legal obligations with regard to bread, and in

the following reign a statute was passed for the express purpose of protecting the public from dishonest bakers, brewers and butchers. This statute is worthy of notice as it is the first in which adulteration of food is specially noted and prohibited. The penalty provided was unique, for the first offence the dishonest dealer was drawn on a hurdle from the Guildhall to his own house, through the streets where most people assembled, with the faulty loaf or other article hanging round his neck. For the second offence he was put in the pillory, and for a third offence his bakery was pulled down and he was put out of business. It is a fortunate thing for some people that such a penalty is not enforced at the present time.

In the reign of George I., in 1725, laws were passed regarding the adulteration of tea and coffee, these laws being enforced by the excise officers.

No matter how good and fresh articles of food may be, they will not remain in that condition long if they are kept in unsanitary places, or exposed to contamination by dust and flies; and a regular inspection of places where food is kept for sale or prepared in any way is absolutely necessary, for in some cases the violation of sanitary laws may be through ignorance on the part of the proprietor; in other cases, through carelessness, and in still a few other cases through pure "cussedness" and an open defiance of the laws of hygiene.

At the present day most of our foods are put up in packages, which not only eliminates the danger from dust and flies, but also from promiscuous handling by possible disease-carriers.

The demand for package goods, wrapped bread, and bottled milk is a sign of awakening interest on the part of the public in a matter in which it is vitally interested—the preservation of public health.